FLIGHT

First Aero Weekly in the World.

Founder and Editor: STANLEY SPOONER.

A Journal devoted to the Interests, Practice, and Progress of Aerial Locomotion and Transport.

OFFICIAL ORGAN OF THE ROYAL AERO CLUB OF THE UNITED KINGDOM.

No. 220. (No. 11, Vol. V.) MARCH 15, 1913. [Registered at the G.P.O. as a Newspaper.] [**Weekly, Price 3d. Post Free, 3½d.**

Flight.

Editorial Office: 44, ST. MARTIN'S LANE, LONDON, W.C.
Telegrams: Truditur, Westrand, London. Telephone: Gerrard 1828.
Annual Subscription Rates, Post Free.
United Kingdom ... 15s. 0d. Abroad ... ... 20s. 0d.

CONTENTS.

EDITORIAL COMMENT.

Stability and Popular Flying.

The Official Notices of the Royal Aero Club came to hand too late last week to enable us to comment upon the certificate of performance issued in respect to a flight with fixed controls by the Dunne aeroplane. We, therefore, take the present opportunity of congratulating the designer of the machine on its successful performance; incidentally, it seems appropriate to congratulate the Royal Aero Club on the interesting character of the event for which the first certificate to be issued under its new competition rules has been awarded.

There are two aspects of distinct interest associated with the occasion—one is general and the other technical. The general aspect relates to the importance of stability as a factor in the promotion of popular flying. There is no getting away from the fact that the aeroplane as it exists to-day is not regarded as quite safe for the average man.

It would be a pity if man's latest invention turned out, after all, to be nothing better than an engine of war. Surely the future of the aeroplane has a more attractive outlook than this. The question of safety, we have often said, is the main issue in respect to the popularising of flight; but equally, of course, it stands to reason that safety is of first-class importance in military work.

In considering the question of safety the subject divides itself automatically under three heads. One relates to the strength of aeroplane structures to withstand the stresses to which they are subjected in the air; the second relates to what is usually called the stability of the aeroplane; while the third is concerned with the risks especially associated with landing.

Although this third section is properly regarded as one of the great difficulties in the extended use of aeroplanes, there have happily been comparatively few serious accidents associated with this phase of flight. With the demand for higher speeds, however, there is no doubt that the landing difficulty assumes very serious proportions, for it is recognised on all sides that safety in this matter primarily depends on being able to check speed in the air before alighting. This, and the possibility of improving undercarriage design, leaves much room for interesting development in the future.

In respect to the strength of aeroplane structures to withstand the stresses to which they are subjected while aloft, there still appear to be some aspects of the situation with which the science is not yet fully acquainted. No one can possibly doubt, in the light of the evidence that is available, that wing structures have collapsed while machines have been flying. They may have collapsed in consequence of inadequate design, or they may have collapsed because they have been subjected to stresses of a totally unforeseen nature.

We have heard competent pilots aver that, on certain very extraordinary occasions, their machines have been struck by wind shocks of an altogether phenomenal violence. The evidence on this point is scanty, but such as there is bears the stamp of quality. Such experiences have occurred, perhaps, only once in the whole career of a pilot, and those who know by personal experience of what it is that we speak know also that once is enough. The wind shock has been likened by one flyer to the shock of a ship striking a submerged rock—a shattering blow, but not necessarily one that upsets the balance of the machine. There is no direct evidence in our possession of any aeroplane having been broken by such shocks, and it is still a moot question whether or no their "bark is worse than their bite." There is no doubt, however, that the wind shock is the one thing that certain pilots really fear in the air.

Most of the stories of its infrequent occurrences agree

in associating the phenomenon with the presence of black thunder-clouds in the sky. This brings us face to face with the study of meteorology and the need for recognising its fundamental association with the development of aerial navigation. It is a vast subject, but it is one that must be mastered.

It would be a mistaken principle, however, to blame abnormal conditions for failures that may have occurred under severe but nevertheless common circumstances. It is, indeed, better to assume that such failures as have occurred have taken place through inadequate design, and to advance the constructive detail accordingly. When Blériot realised that it was desirable to strengthen the top bracing of his monoplanes he lost very little time, it will be remembered, in bringing his outstanding machines into line with his new ideas. At the present time, unfortunately, it is less easy to locate structural weaknesses. Judging by the report of the monoplane committee, the bracing wires and the fabric are among the strongest details of the wing structure. It is, therefore, to the spars, the ribs, and to the internal bracing that it would seem most profitable to pay special attention.

Similarly, in respect to stability, there may be abnormal circumstances in flight that it would be beyond the capacity of any control, whether automatic or human, to circumvent. But that by no means necessarily limits the degree of security attainable to that at present available in modern machines. We have small sympathy with fantastic inventions that seek to arrive at perfection in a single stride, but we have every encouragement for the persevering pioneer who has good reason for believing himself possessed of something worth while, and who does his utmost to bring it to a state of practical utility.

In Mr. Dunne, the movement has a student of this order. His one-minute circular flight with fixed controls may seem an accomplishment of minor magnitude when judged solely by the ordinary standards of modern flight, but we draw special attention to it nevertheless. The future alone can prove the real merit of this record, and incidentally show the extent of the connection between stability and negative wing tips.

◆ ◆ ◆

Engineers at the R.A.F.

We have received a letter from the Amalgamated Society of Engineers upon which we feel bound to make some comment in the cause of common justice, although its proper place for publication *in extenso* is not in this journal. The Society protests against certain criticisms of an extremely serious character made by a contemporary anent the conduct of the workmen employed at the Royal Aircraft Factory. The stigma, which amounts to an accusation of organised laziness and abuse of privilege, is one that a Society having for its motto "Be united and industrious" can scarcely allow to pass without notice, notwithstanding the unsatisfactory character of the evidence put forward in its support. We cannot, of course, in any sense constitute ourselves judges in this matter, but on a question of this character we recognise the right of the men concerned to make a public denial of a public attack on their integrity, and to that end we bring the matter to the notice of our readers.

Incidentally, it affords us the opportunity of again expressing the opinion that the Royal Aircraft Factory is a first-class national asset, and that it has accomplished uncommonly good work for the money that has been spent upon it. There are those, we know, who profess to believe that all the money voted for aeronautics should have been spent in the purchase of aeroplanes constructed by the trade. The reasons why we have been unable to agree are simple. The Government has been parsimonious, but it has laid its plans with some system. It would have been a useless and a vain beating of the air to have attempted to force upon the authorities a one-sided policy in their initial work.

Now, however, that aeronautics in England has begun in some measure to awaken an intelligent interest on the part of those not directly concerned with its technique, there may be some chance of arousing a recognition of the necessity for taking unusual measures in respect to an unusual situation. There may be some chance, for instance, of convincing the Government that it may be the cheapest in the long-run to be lavish with orders for aeroplanes, and especially for aeroplane engines, beyond the measure of its present requirements.

Particularly, we say, may this be worth while in respect to engines, for the development of a successful aeroplane motor takes time, and is not to be accomplished on the spur of the moment. There are several motor car firms of experience who would think it worth while to tackle the problem if they saw the prospect of sufficient return. From a commercial standpoint, such a manufacturer would probably want to put through a batch of, say, 150 engines at a time. His prospect of securing an order in open competition is comparatively remote unless the number to be purchased in all is somewhere in the neighbourhood of 500. We believe it would be a very good thing, indeed, for the country if the Government were to make a clear announcement that they were prepared to buy 500 engines this year. It is a suggestion that we might have made ages ago, but what possible chance was there of succeeding along such a line while the country at large was still deep in its apathy to the subject at large. Now that there is some evidence of a slight awakening, it is necessary that those who are thus interesting themselves should begin by degrees to understand some of the salient technical points in the problem.

One of those technical points is the fact that neither aeroplanes nor airships are of the least use whatever, unless equipped with good engines. Most of the engines used in this country are not built here. It is, however, absolutely essential that they should be built here if we are to develop the aeroplane to its fullest capacity as an instrument of war. In order that the country may have the best that its people can provide, it is necessary to entice the best talent to take an interest in the problem. To that end, as we have said, a definite announcement by the Government of its willingness to purchase 500 engines this year would be, we believe, the cheapest and the most satisfactory procedure. These engines, having been bought by the Government, might usefully be supplied by the Government to aeroplane constructors who needed them for the completion of Government contracts. It is one of the problems of the aeroplane constructor to-day, to know how to ensure the delivery of just those one or two makes of engine that will serve his purpose. For instance, if several firms receive orders to construct the BE 2 type army biplane, there is a rush to secure immediate deliveries of Renault engines, for which type of motor that particular machine has been designed, whatever opinions may exist as to this engine being the best to instal. Under such circumstances, it is clear that the less influential builders may suffer by comparison with other competitors for early delivery: the country as a whole is also at a disadvantage for the same reason. The wholesale advance purchase of British-built motors by the Government would, therefore, we think be of very material benefit to the aeroplane industry.

MEN OF MOMENT IN THE WORLD OF FLIGHT.

MR. FRANK K. McCLEAN, who, as a very expert amateur flyer, and by his great and helpful work at Eastchurch has done so much for the practical side of aviation.

THE WRIGHT PATENT LITIGATION ABROAD.

IT is interesting to observe how the three years' patent litigation in the United States, Germany and France, on which more than £50,000 has been spent, has now reached its final stage simultaneously in all three countries.

In the United States the action against Curtiss is now disposed of, the Court at Buffalo having upheld the validity of the Wright Brothers' patent.

In Germany, the Supreme Court at Leipzig gave its decision orally on February 26th, to the effect that the Wright Brothers were the inventors of the warping *per se* and also of the warping and rudder control combined, but although it did not support the monopoly for the warping by itself, it confirmed the German patent as valid on amendment being made to exclude warping broadly *per se*. The German Court left the claim standing for the combined rudder and warping, without making any stipulation that these two mechanisms need be mechanically connected.

The French case has now been heard in Paris, and judgment will be delivered on 19th inst., and seeing that there is no official report of the oral judgment at Leipzig, those interested in France are discussing the German judgment and reading their hopes into the words of the judges. In view of the published opinions by those who were not present, it may be interesting to quote Mr. Orville Wright's observations made to a representative of the *New York Herald* in Paris on the 7th inst., after his return from being present at the Trial at Leipzig :—

Mr. Wright said that it is an error to suppose that the decision given by the Leipzig Court recently recognises as valid or patentable only a mechanical combination, or rather coupling, of the warping wing movement with the aeroplane rudder. On the contrary, this verdict, he asserted, means that all aeroplanes with warping wings and a rudder, notwithstanding that the two be independent one of the other, constitute an infringement of the Wright patents.

"The decision of the Supreme Court of Germany at Leipzig," continued Mr. Wright, "was an oral one. The written decision will be made public later. After considering the patents of Mouillard, Boulton, Robitsch and Ader, the Court held that we were the inventors of warping, and that it was only on account of disclosures made by our friend Chanute and ourselves, prior to making our application for the patent, that the Court was compelled to reduce the claim so as to exclude warping *per se*. The Court then stated that the function of a rudder on a flying machine is not merely that of a ship's rudder, but that it is a necessity for maintaining balance on a flying machine having warping wings.

"It held further that we were the first to discover and use warping wings and rudder together, on the same machine. The Court did not say that the invention was restricted to the mechanical coupling of these two elements, as has been alleged.

"That our claim to the patent for the combined use of warping wings and a rudder is a broad one is shown by the fact that the director of a prominent German aeroplane factory called on me in Berlin after the Leipzig decision had been handed down to arrange for a licence to manufacture under the patent. He said : 'According to the decision of the Supreme Court every machine built in Germany is an infringement.'"

British manufacturers will no doubt be interested in these foreign judgments, because up to the present, we believe, only one licence has been applied for to work under the Wright patents in England.

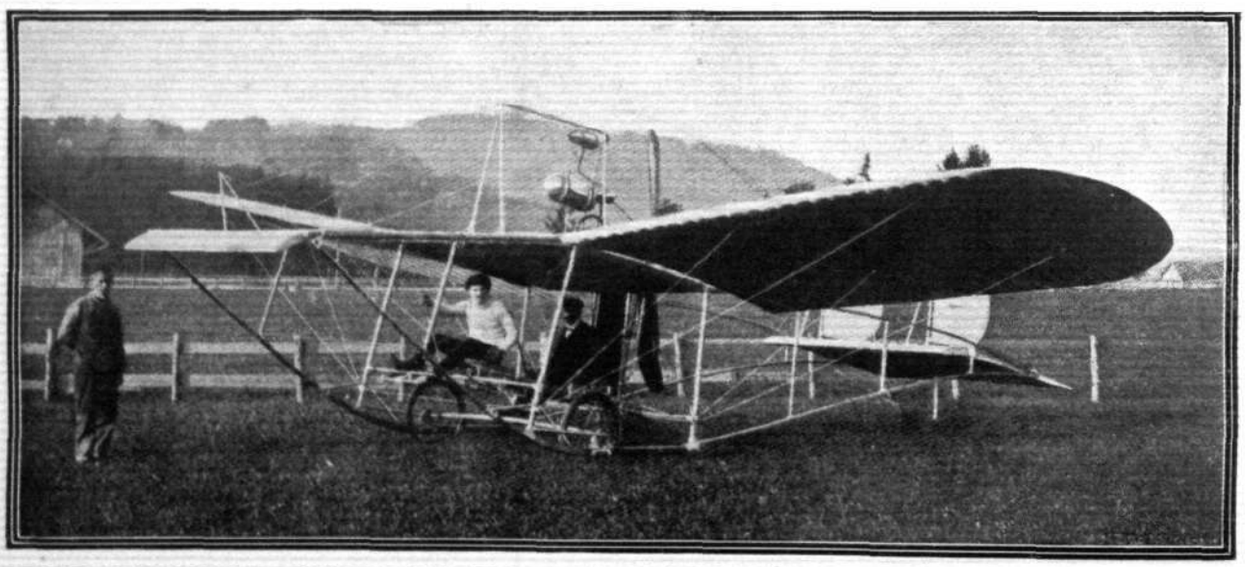
In order to enable the patent situation in Germany to be clearly understood by readers of FLIGHT, we have interviewed Mr. Griffith Brewer, who explained this somewhat complicated technical question as follows :—

"There are two general methods of resisting a patent, one by proving the patent to be bad, and the other by proving the alleged infringement not to come within the scope of the patent. In cases where it is evident that escape by this second channel is not open, actions are brought by the infringers against the owners for the annulment of the patent, because if the patent can be declared void anyone may infringe with impunity.

"It was an action to annul the Wright patent which was brought in Germany, and the Supreme Court of Leipzig has now decided to uphold the patent on its scope being reduced to exclude the warping by itself. No other reduction is made in the patent, and, consequently, all aeroplanes which warp and have a vertical rudder, will still infringe the German patent in the same manner they did before the action.

"The judges at Leipzig, in giving their decision, expressed the view that the Wright Brothers were the inventors of the warping *per se*, and also of the combined warping and rudder, and they made no statement that the warping and rudder control had to be mechanically connected in order to come within the ambit of the claims. Statements to that limiting effect may therefore be disregarded, and seeing that the judges in an action for annulment are not called upon to interpret whether certain constructions come within the claims, it is obvious that they would not go outside their duties and decide whether or not aeroplanes of certain manufacturers came within the claims.

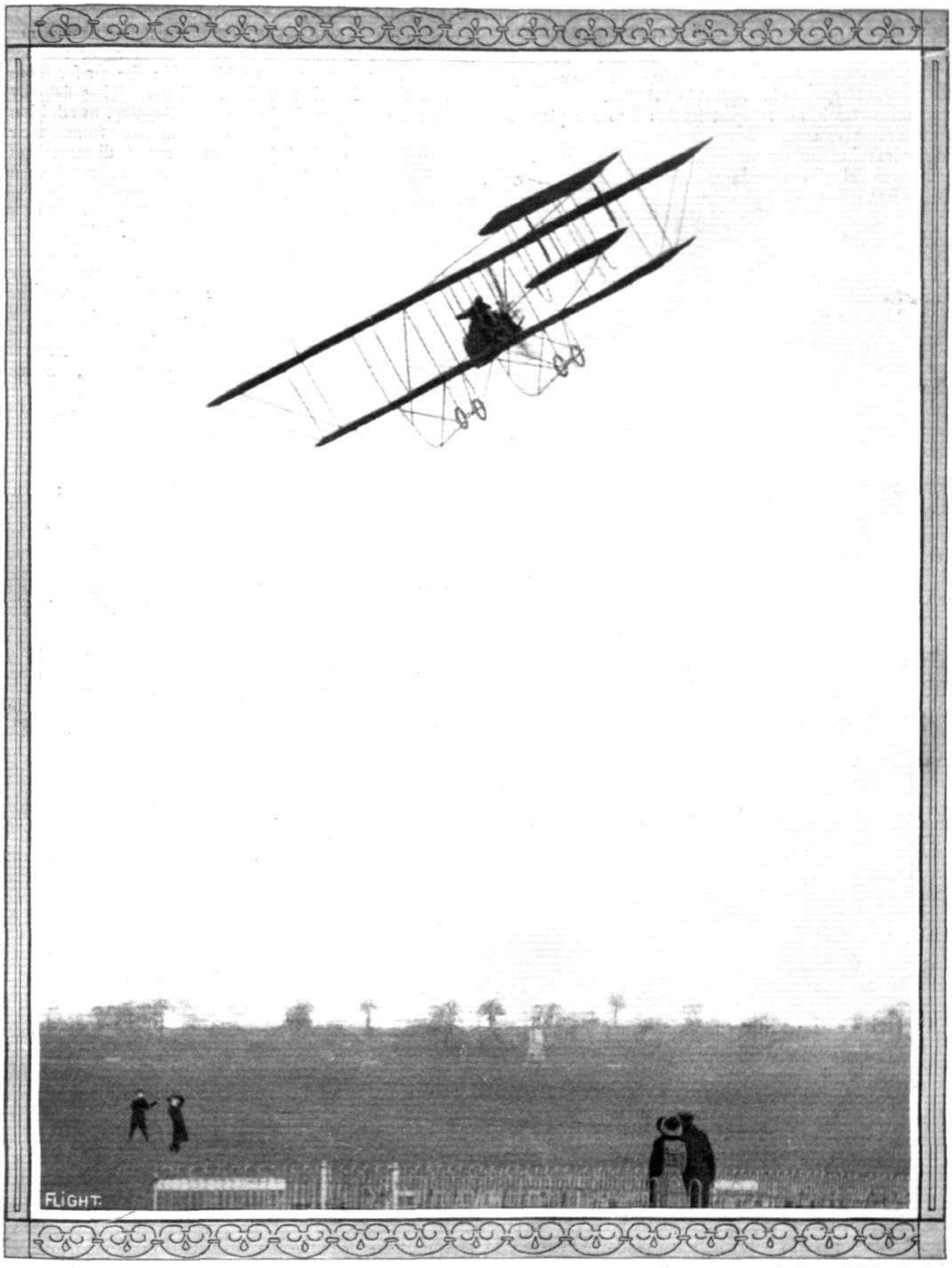
"Warping on a machine which does not carry a rudder is thus free to all in Germany, but that is all the decision actually means."



A NEW SWISS-BUILT MONOPLANE—THE 60-H.P. OERLIKON-ROSSIER.—This machine has been under the pilotage of Kunkler, who has been flying at the Dübendorf Aerodrome. It is now to be fitted with floats and tested for water work.

The Russian Military Competition.

THE Russian military authorities are now busy with the arrangements for the competition for military aeroplanes which is to be held next August, and in which special importance will be paid to facilities in the competing machines for observation and the launching of projectiles. The Minister of War has asked the Government for a grant of £7,406 of which £5,820 is to be disbursed in prizes.



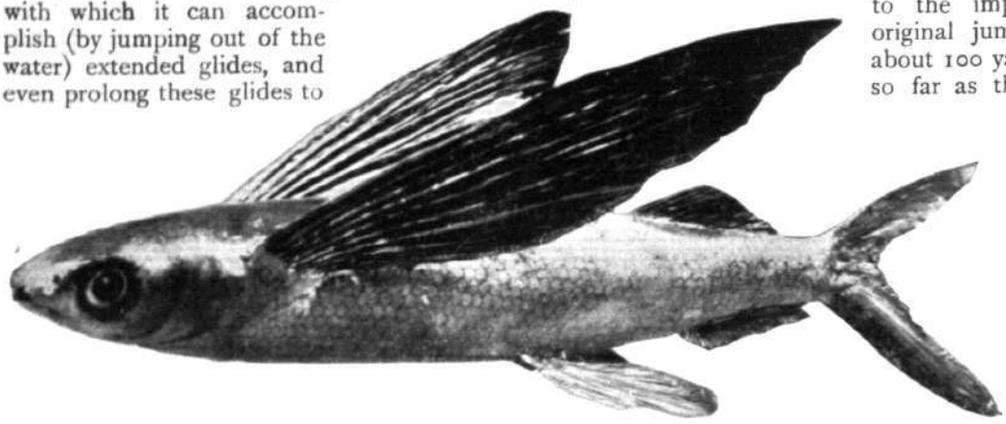
A fine piece of banking by Pierre Verrier, with a passenger, on a Maurice Farman at Hendon Aerodrome.

FLYING FISH.

EXAMPLES OF NATURE'S GLIDERS.

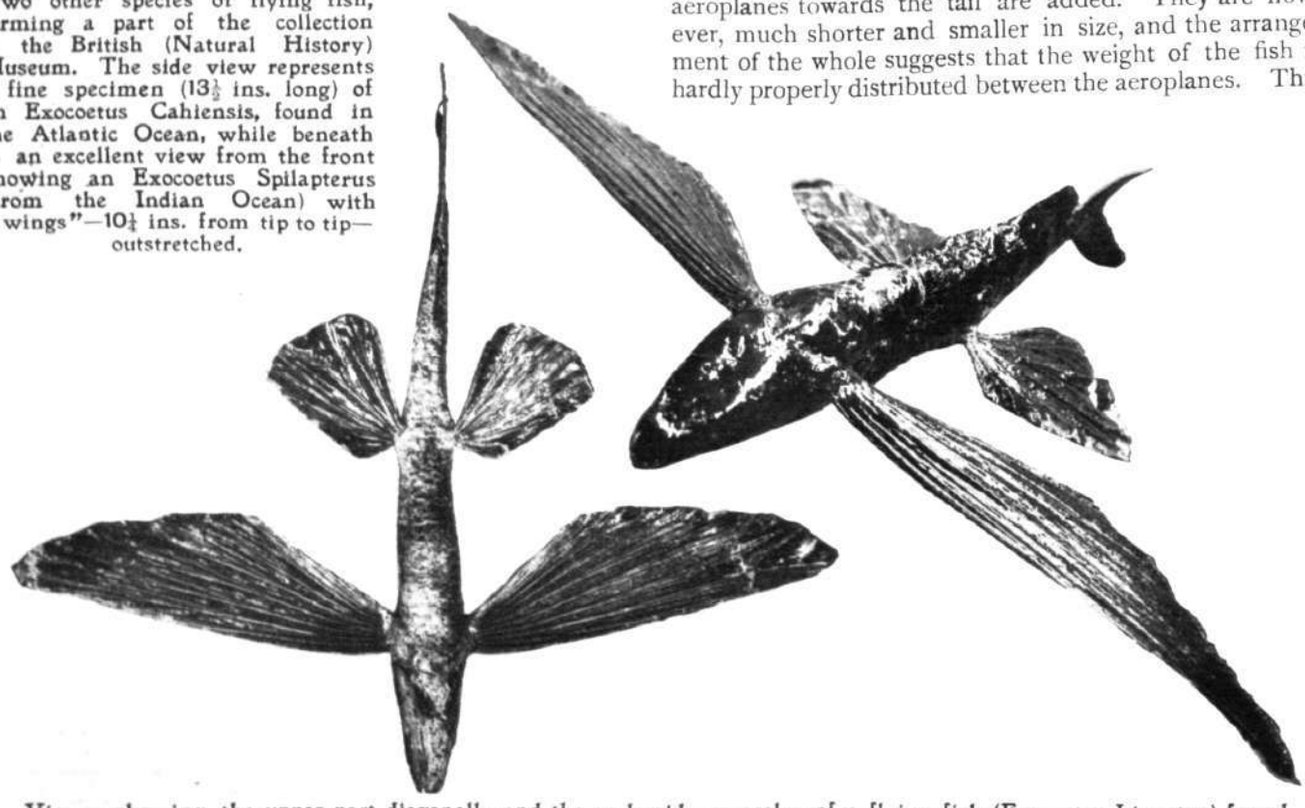
Of the many forms of flight that demonstrated by the flying fish is by no means the least interesting, nor is the study of the quaint creatures belonging to this category to be despised by those interested in aviation.

It is a fish that has developed its fins into aeroplanes, with which it can accomplish (by jumping out of the water) extended glides, and even prolong these glides to a certain extent by flapping. But the flying fish is not really a flyer, in the sense in which the bird or the bat are flyers, for he cannot keep himself in the air for more than a limited period of time. Expert flying fish, by adding the impetus obtainable from flapping, in addition to the impetus obtained from their original jump, can cover distances of about 100 yards, but seldom travel even so far as that without returning to the water, ready to make another leap. The three species which we illustrate —thanks largely to the very great courtesy of Dr. Ridewood, who gave us every facility for taking our photographs at the Natural History Museum, South Kensington — are the *Exocoetus Lineatus*, captured off St. Vincent, in the Cape Verd Islands (two views, one from beneath, one from above); the *Exocoetus Cahiensis*, found in the Atlantic Ocean; and the *Exocoetus Spilapterus*, found in the Indian Ocean.



Two other species of flying fish, forming a part of the collection at the British (Natural History) Museum. The side view represents a fine specimen (13⅜ ins. long) of an Exocoetus Cahiensis, found in the Atlantic Ocean, while beneath is an excellent view from the front showing an Exocoetus Spilapterus (from the Indian Ocean) with "wings"—10¼ ins. from tip to tip—outstretched.

An interesting feature is that in addition to the two large aeroplanes or wings in front, which are designed evidently to carry the bulk of the weight (but which are too forward to give an effective balance), smaller aeroplanes towards the tail are added. They are however, much shorter and smaller in size, and the arrangement of the whole suggests that the weight of the fish is hardly properly distributed between the aeroplanes. This



Views—showing the upper part diagonally and the underside squarely—of a flying fish (Exocoetus Lineatus) found off St. Vincent, Cape Verd Islands. Our photographs—taken at the Natural History Museum, South Kensington, with the kind assistance of Dr. Ridewood—clearly show the two sets of "wings," or aeroplanes, that enable this curious type of fish to "glide" a considerable distance above the surface of the water. This fish is 19 ins. long, and measures 21¼ ins. from tip to tip of the "wings."

may, perhaps, to some extent explain the shortness of flight accomplished. But it is encouraging for human experimenters to be reminded of the fact that not only have birds, which are a race to themselves, accomplished flight, but that the same problem has also been solved by the bats, which are mammals, while in addition to these two successful aviators we have the flying fish.

When we consider the purely gliding action of the flying fish, the careful observation of his "wings" becomes a subject of keen interest. It will be noticed that they are very flat, straight, rigid, and hardly at all cambered. In this respect they differ entirely from the feathered wings of all long-distance flying birds, which are curved upwards and inwards in front in a marked degree. In view of their comparatively small area for supporting the weight these "wings" have to carry, a flying fish may claim to rank as a decidedly efficient "glider."

⊛ ⊛ ⊛ ⊛

AUSTRO-DAIMLER AERO MOTORS.

AN interesting test was carried out in Rome recently on the new model 65-h.p. Austro-Daimler Aero Motor, ordered by the Battaglione Spezialisti. The test, as will be seen, was by no means as severe as might have been imposed and successfully passed by this excellent motor, but the ease with which the engine completed them marks the 65-h.p. Austro-Daimler as an extremely reliable production and, moreover, one showing an unusually low fuel consumption. Concerning the Austro-Daimler aero engine there is scarcely any need to remind readers that it was their 120-h.p. model that assisted S. F. Cody in winning two "firsts" in the military aeroplane trials. The Grahame-White Co., Ltd., have purchased two, a 90-h.p. and a 120-h.p. model, the first of which is fitted to the new G.-W. military biplane at Hendon. Mr. T. O. M. Sopwith, too, has used the 90-h.p. model Austro-Daimler in his new hydro-biplane, which was recently completed at his Kingston-on-Thames works, and was on view at Olympia.

In accordance with the conditions of sale, the engine was subjected to the following tests in the presence of Capt. Scaparo representing the Battaglione Spezialisti :—

A run of four hours with full load on a fan brake (certified correct).

Average number of revolutions per minute, 1,190.

Brake horse-power developed 60-h.p.

The test was carried out strictly in accordance with the terms of the contract, that is to say, no special arrangements for cooling, by fan or other means used, and no adjustments were allowed to be made, except those which could be effected during actual flight.

There were no stipulations in the contract regarding the consumption of petrol and lubricating oil, nevertheless this was checked and was as follows :—

Petrol, 60·95 kilos., 254 grammes per h.p. per hour.

Lubricating oil, 2·3 kilos., 9·6 grammes per h.p. per hour.

The first test was followed by a run of 1½ hours' duration at maximum output, obtained as before on the fan brake (certified correct).

Average number of revolutions per minute 1,330.

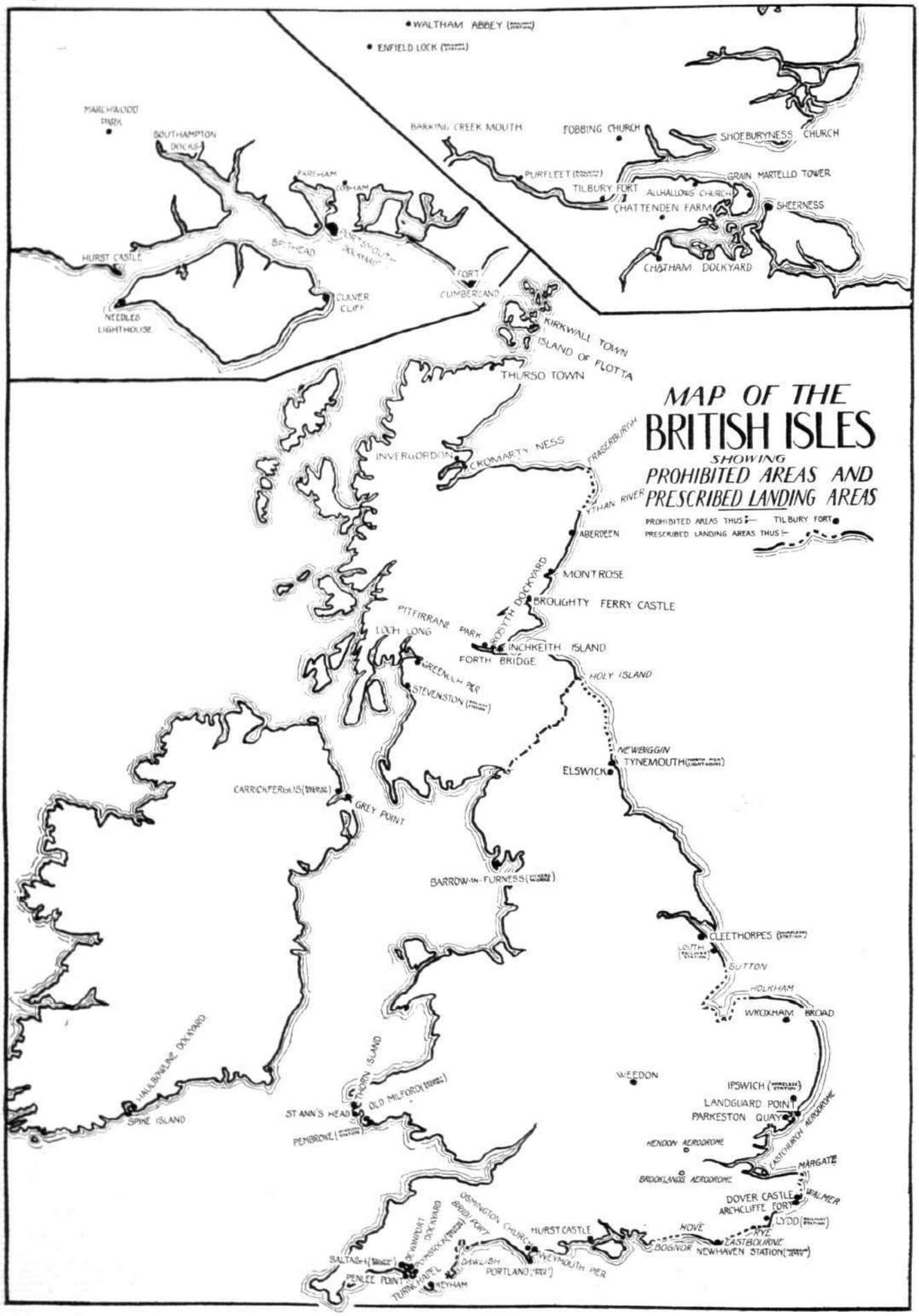
Brake horse-power developed 71·5-h.p.

Petrol consumption, 25·07 kilos., 235 grammes per h.p. per hour.

Lubricating oil, ·85 kilos., 8 grammes per h.p. hour.

The third test was carried out with the engine inclined at an angle of 15° with full load. As the test bench apparatus was not suitable for taking a test with the engine at an angle (the bearing of the fan brake being fixed in the masonry of the wall), this test was carried out with a propeller fitted in the same manner as on an aeroplane. The Battaglione Spezialisti declared themselves satisfied with this method of carrying out the test. The engine ran for half an hour under these conditions quite regularly and without a stop. The engine, having satisfactorily fulfilled all the conditions of the contract, was duly accepted.

Col. Seely, the British Minister for War, just before his flight at the military aviation ground at Madrid with Capt. Barron in a Bristol biplane.


WALTHAM ABBEY
ENFIELD LOCK
MARCHWOOD PARK
SOUTHAMPTON DOCKS
FAREHAM
GOSPORT
BARKING CREEK MOUTH
FOBBING CHURCH
SHOEBURYNESS CHURCH
PURFLEET
TILBURY FORT
GRAIN MARTELLO TOWER
ALLHALLOWS CHURCH
CHATTENDEN FARM
SHEERNESS
CHATHAM DOCKYARD
HURST CASTLE
SPITHEAD
PORT SOUTH
FORT CUMBERLAND
CULVER CLIFF
NEEDLES LIGHTHOUSE
KIRKWALL TOWN
ISLAND OF FLOTTA
THURSO TOWN
MAP OF THE
BRITISH ISLES
SHOWING
PROHIBITED AREAS AND
PRESCRIBED LANDING AREAS
PROHIBITED AREAS THUS
TILBURY FORT
PRESCRIBED LANDING AREAS THUS
INVERGORDON
CROMARTY NESS
FRASERBURGH
YTHAN RIVER
ABERDEEN
MONTROSE
ROSYTH DOCKYARD
BROUGHTY FERRY CASTLE
PITFIRRANE PARK
LOCH LONG
INCHKEITH ISLAND
FORTH BRIDGE
GREENOCK PIER
STEVENSTON
HOLY ISLAND
NEWBIGGIN
TYNEMOUTH
ELSWICK
CARRICKFERGUS
GREY POINT
BARROW-IN-FURNESS
CLEETHORPES
LOUTH
SUTTON
HOLKHAM
WROXHAM BROAD
HALBOWLINE DOCKYARD
THORN ISLAND
OLD MILFORD
SPIKE ISLAND
ST ANN'S HEAD
PEMBROKE
WEEDON
IPSWICH
LANDGUARD POINT
PARKESTON QUAY
EASTCHURCH AERODROME
HENDON AERODROME
MARGATE
BROOKLANDS AERODROME
DOVER CASTLE
ARCHCLIFFE FORT
WALMER
LYDD
OSBORNE
CHURCH
BRIDD POINT
HURST CASTLE
HOVE
RYE
EASTBOURNE
BOGNOR
NEWHAVEN STATION
PORTSMOUTH DOCKYARD
SALTASH
DEVONPORT DOCKYARD
DAWLISH
WEYMOUTH PIER
PORTLAND
PENLEE POINT
TURNCHAPEL
KEYHAM

SOME THOUGHTS ON STABILITY AND CONTROL.

By A. E. BERRIMAN.

V.—Longitudinal Stability and Speed Range. Naturally Stable Wing Sections. Effect of the Position of the Maximum Camber. The Experiments of E. N. Fales.

IN the preceding part of this series of articles, longitudinal stability and control were considered from the standpoint of a modern machine having wings of single camber, a tail organ carried on a fuselage some distance to the rear, with an elevator forming a hinged extension of the tail.

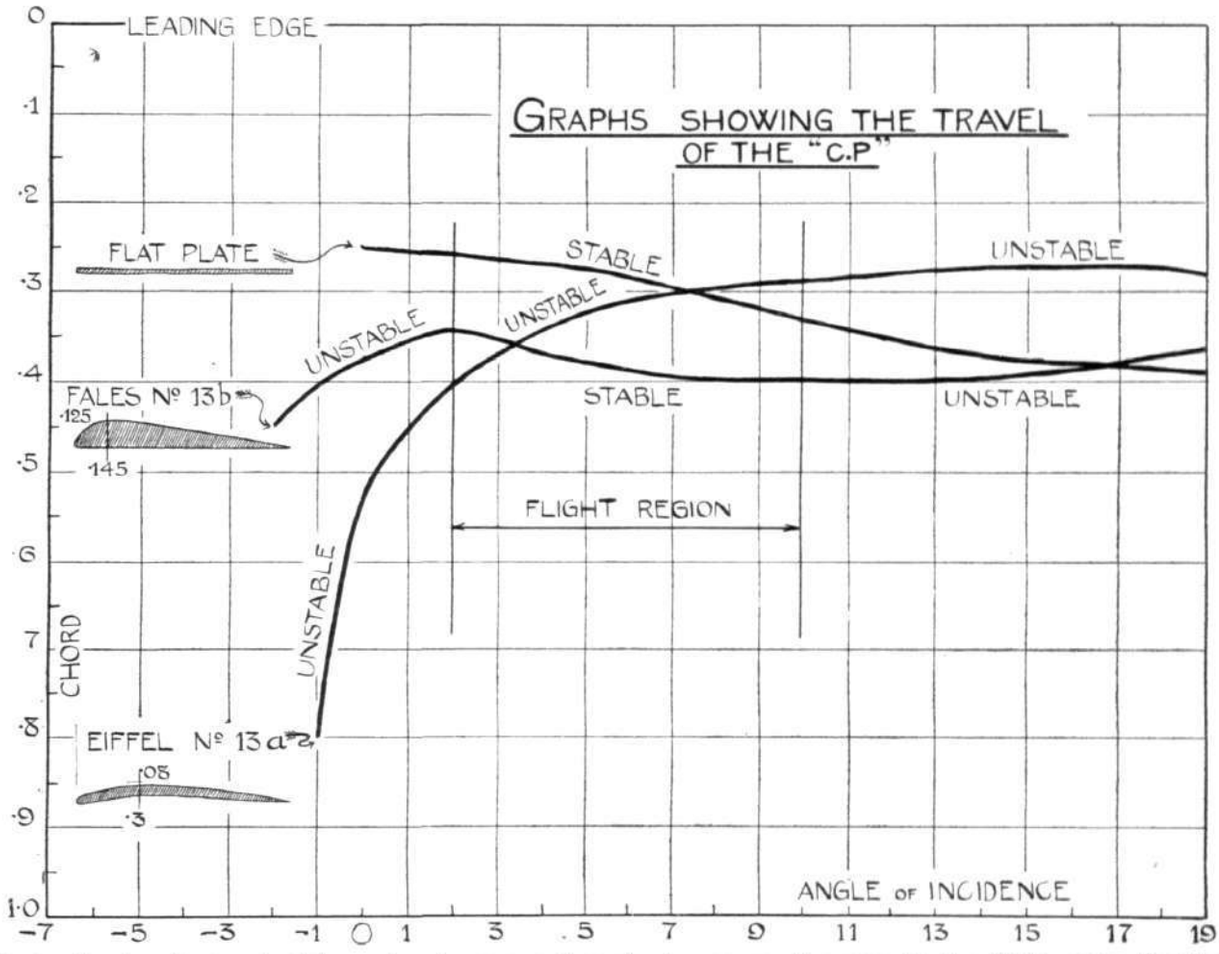
It was explained that wing sections of single camber, as used on modern aeroplanes, are inherently unstable about the transverse axis, and that the longitudinal stability of the system is only assured in a practical aeroplane by the fitting of a fixed tail plane having a lesser effective angle of incidence than the main wings. In effect, the plane of the main wings and the plane of the tail form a dihedral angle, which principle is commonly referred to as the longitudinal dihedral or the longitudinal V.

It was also argued that the effect of setting the elevator flap to a slight positive or negative angle of incidence in flight, and holding it in that position, caused a readjustment of the neutral axis representing the attitude of equilibrium. Thus, by setting the elevator flap, the balanced attitude of the machine in flight might be slightly *cabré* or slightly "tail up," as compared with a horizontal attitude of the fuselage, which is, presumably, intended as proper to the design of the machine. This resetting of the neutral axis by a slight change in the elevator position is due to the fact that the fixed tail plane itself counteracts the elevator as the machine tilts out of its normal position.

If a fixed tail plane is not present, then the longitudinal stability of the system depends solely on the pilot holding the elevator flap in the position proper to flight, and, there will be only one such position for natural equilibrium with a given distribution of the weight. For any other setting of the elevator, there will be an unbalanced couple about the tranverse axis, tending to "stall" the machine or make it dive, as the case may be.

It is evident, therefore, that the presence of a *fixed* tail plane facilitates variable *horizontal* speed by the use of the elevator, because it enables the machine to be *balanced* in a variety of attitudes covering a range of useful angles of attack. A machine without a fixed tail plane would have only one attitude of equilibrium, and only one horizontal flight speed, unless the angle of incidence of the wings was variable independently of the attitude of the body. Also, so long as a system possesses sensitive longitudinal stability in respect to a particular attitude of equilibrium, it will have only one horizontal speed, for the attitude will correspond to a certain angle of incidence which will require neither more nor less than a certain velocity to support the loading.

Variable horizontal speed is ordinarily regarded as a most important quality in aeroplane design, but the real virtue associated therewith is, I think, mainly the evidence that it shows of a wide



Charts showing the travel of the centre of pressure throughout a range of angles in the flight region for three kinds of aerofoil. Special interest attaches to the stable portion of the graph of the Fales' wing, which lies in the flight region between 2° and 10°.

margin of available engine power. In itself, the ability to vary the *horizontal* flight-speed in straight forward flight is not, it seems to me, a primary essential in a practical aeroplane, provided always that adequate reserve power is, nevertheless, available.

The problem of alighting is a problem apart. It is not variable speed as such, but a low speed in the absolute that is associated with safety in landing. Provided that the speed of the machine could safely and surely be checked in the air just before contact with the earth, it would, apparently, satisfy the essential conditions, even if it represented an abnormal or even impossible mode of continuous flight.

Many machines that demonstrate a satisfactory speed range from the power reserve standpoint are not thereby rendered capable of flying as slowly as will relieve them of the need for a very skilled hand on the control when landing. To be equally safe in this respect similar aeroplanes must fly equally slowly.

Given means for alighting safely, and sufficient reserve power for manœuvring and combating the weather, then a one-speed machine, that is to say one *horizontal* speed, should not be a serious disadvantage on this account. So long as a machine possesses the ability to vary its horizontal speed by the use of the elevator, it is also liable to be "stalled," which would not happen if the natural stability of the system were not tampered with beyond the momentary use of the elevator for damping out natural oscillations.

From many standpoints, the problem of longitudinal stability is seen to be associated with the maintenance of the normal speed for which the machine was designed, and pilots themselves are now more than ever coming to regard the presence of a speed indicator on their aeroplanes as a most valuable acquisition in the sense that it is a visible danger signal. Sensitive weathercock longitudinal stability would tend of its own accord to maintain that normal speed.

In respect to a study of weathercock longitudinal stability generally, and a sensitive system in particular, especial interest naturally attaches to any wing sections that display inherent longitudinal stability of their own accord. Such a wing would, in principle, fly without a long fixed tail, although it would doubtless need a hinged flap for damping out oscillations.

It was pointed out in the preceding article that wings of double curvature, *i.e.*, those having an upturned trailing edge, potentially possessed the quality of inherent longitudinal stability. Such sections have recently been tested by Eiffel, but the results have not yet been made public except in respect to one or two broad facts. It has, however, apparently been proved that the c.p. on such a wing section moves forward with decreasing angles of incidence even when those angles are within the flight region. As long ago as 1905, Mr. Turnbull had wing sections of this form under observation at his laboratory at Rothesay, N.B., Canada, and reported the same quality.

Comparatively recently, some experimental research of an equally interesting character has been carried out by Mr. E. N. Fales at the Massachusetts Institute of Technology, U.S.A., and he communicated the essential results to *Engineering* in an article published in the issue of June 28th, 1912. Mr. Fales investigated more particularly the effect of changing the position as well as the height of the maximum camber, an investigation which is also proceeding at the National Physical Laboratory.

In one series of tests, Mr. Fales took fixed maximum ordinates, and varied their positions, while in another series he took a fixed position and varied the heights of the maximum ordinates.

The various families of curves were published with the article, and from them I have developed one in particular, which seemed to be the most interesting. It is incorporated in one of the accompanying charts. The wing section under observation belonged to a flat-bottomed series, having the maximum ordinate situated 0·145 of the chord from the leading edge. The particular section in question had a maximum camber of 0·125 of the chord at this point. It will be observed that not only is the camber greater than usual, but that the maximum ordinate is much nearer the leading edge. The corresponding values for Eiffel No. 13 *bis* are for the ordinate 0·08, and for the position about 0·3.

The especial interest attaching to this section lies in the fact that it demonstrated inherent longitudinal weathercock stability between the angles of 2° and 10° incidence. That is to say, it was naturally stable within a region that is feasible for flight.

In the absence of precise data, an approximation to the angles of incidence that ordinarily obtain in the flight region covered by

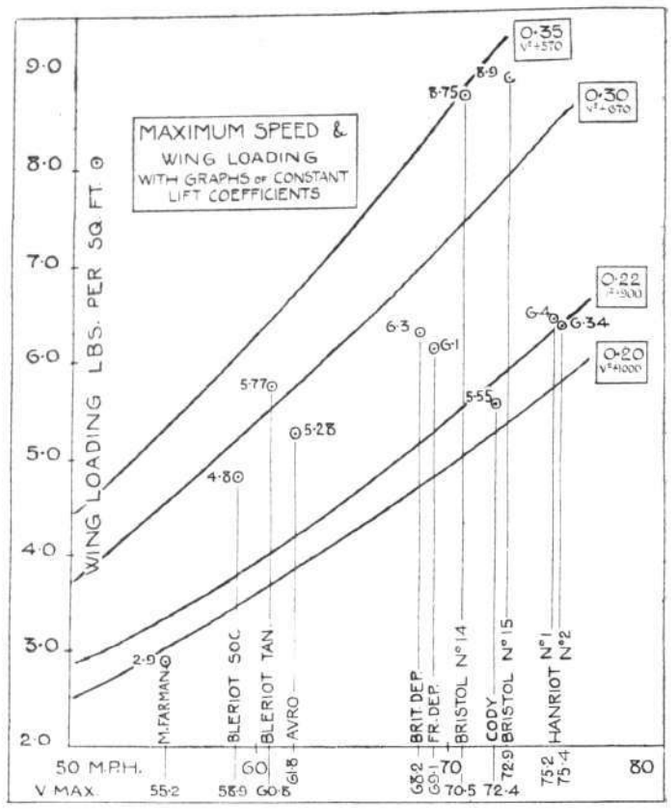
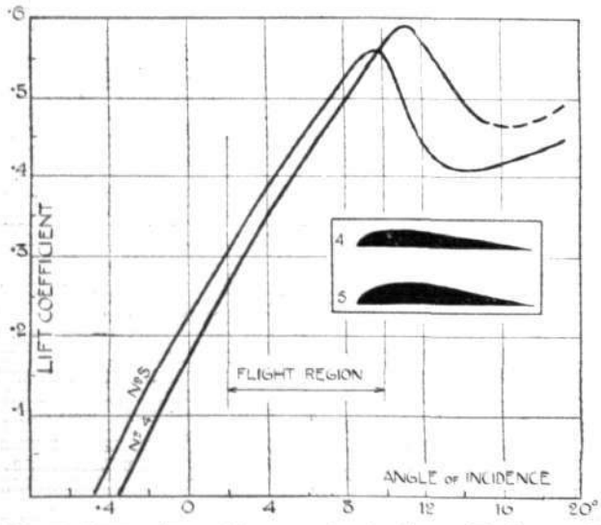
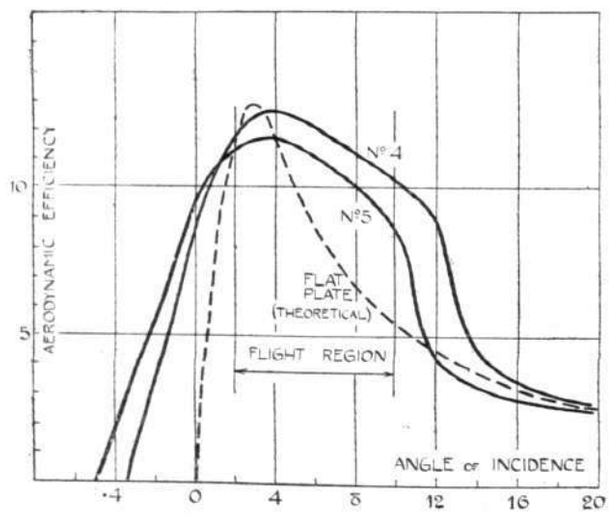


Chart illustrating the maximum speeds of some of the machines in the Military Trials, with graphs drawn thereon showing the lift coefficient corresponding to different wing loadings over the speed range.

practical aeroplanes, may be obtained by considering the speed limits of the machines in the Military Aeroplane Trials. In an accompanying chart, the maximum speeds of several machines are plotted against their wing loadings, and graphs of constant lift coefficients have been superimposed on the chart.





Charts drawn from diagrams in the latest Technical Report of the Advisory Committee, illustrating characteristic curves of lift coefficient and aerodynamic efficiencies for two flat-bottomed wing sections, the aerodynamic efficiency is the ratio of the lift to the resistance. The efficiency of a flat plate cannot anywhere exceed the cotangent of the angle of inclination, but the efficiency of a cambered wing commonly crosses a curve of cotangents in the neighbourhood of 4° or 5°.

It will be observed that the majority of the machines attained their maximum speed between the two graphs representing lift coefficients* of 0·3 and 0·2.

The angle of incidence required to give a lift coefficient in the order of from ·2 to ·3 depends, of course, on the shape of the wing. For a series of similar wings tested at the N.P.L., all of which had flat under sides, the lift coefficient at a given angle of incidence below the critical angle increased with the height of the maximum ordinate. One of the profiles so tested, No. 4, had an upper surface corresponding to Eiffel No. 13 *bis*, which is also known as Blériot No. 11 *bis*, and has been much used as a basis for the design of wings employed on other aeroplanes.

A chart reproduced from the latest technical report of the Advisory Committee shows the lift coefficients for the No. 4 section throughout a range of angles, and it will be observed that a lift coefficient of 0·2 obtains for an angle of incidence of about ½°, while a lift coefficient of 0·3 corresponds to an angle of incidence of 3°.

From the fact that these lift coefficients cover the range of *maximum* flight speeds, it is evident that the normal attitude corresponds to a somewhat coarser angle of attack.

One of the most interesting results associated with the particular series of tests to which reference has just been made was that the maximum aerodynamic efficiency, or ratio of lift to resistance, occurred always in the neighbourhood of 4° angle of incidence. It is apparent that for a one-speed machine, such as is now under consideration, it is desirable that the wings should normally fly in their attitude of maximum efficiency, and so far as this particular type of section is concerned the angle in question would be approximately 4°, as is shown by the accompanying chart that illustrates the lift-resistance ratios. The "aerodynamic efficiency" for wing No. 4 at 4° is about 12½.

The corresponding graphs for the wing sections used by Mr. Fales are not available. The sections tested by the N.P.L. have the position of their maximum ordinate much further from the leading edge, but among the flat-bottomed sections so tested there is one, No. 5, that has the height of the maximum ordinate approximately the same as that in the Fales' wing section, No. 13*b*, which is the section to which I have made particular reference. Although there is no reason to suppose that the characteristics for the Fales' wing would be similar to those of the N.P.L. series, the N.P.L. section, No. 5, is included, as a matter of interest, in the chart that also contains the N.P.L. wing No. 4, to which reference has previously been made.

If the Fales' wing did possess a similar characteristic to that of the N.P.L. wing No. 4, then an angle of incidence of 4° would lie in the middle of its most stable region, as is shown by the slope of the graph in the chart showing the travel of the c.p. It would also give a lift coefficient of 0·35, which would serve to lift 4·4 lbs. per sq. ft. at 50 m.p.h. Other corresponding wing loadings for different speeds can be seen from the 0·35 graph on the speed chart.

The graph of the Fales' wing on the chart showing the travel of the c.p. is prepared from a small portion of one of the curves drawn by Mr. Fales. It is on a much larger scale, however, so as to emphasise the movement of the c.p. in the flight region. An interesting feature of the Fales' wing is that it is unstable on both sides of the flight region, *i.e.*, from 2 to 10°.

On the same chart I have placed a graph taken from the latest technical report of the Advisory Committee showing the travel of the c.p. on a wing section corresponding to Eiffel 13 *bis*. It is interesting to observe that the instability of this wing is more pronounced at angles below 2° than at angles above 2°, which emphasises the inadvisability of forcing a wing section of this kind to fly at a very fine angle in a system that is designed for normal longitudinal stability at some coarser angle. When the angle becomes finer than 2° the travel of the centre of pressure towards the rear is very marked indeed, and might well endanger the control of the machine.

For the sake of comparison I have also introduced a graph showing the travel of the centre of pressure on a flat plate, which is stable for all angles of incidence.

One practical consideration of great importance is whether wing sections of the Fales kind would permit of a rear spar in their construction.

* The lift coefficient is the numerical factor, C, in the expression $C\rho v^2$, where ρ is the density of the air and v is the flight speed in feet per second. If $\rho/g = \frac{1}{420}$ then $\rho v^2 = \frac{V^2}{200}$, where V is the flight speed in m.p.h. Thus, a lift coefficient 0·2 gives the formula $\frac{0{\cdot}2V^2}{200} = \frac{V^2}{1000}$ as the ratio of wing loading to speed for the case in point. Similarly, the coefficient 0·22 corresponds to $V^2 \div 900$, while the coefficients 0·3 and 0·35 are represented by $V^2 \div 670$ and $V^2 \div 570$, respectively, on the chart.

⊛ ⊛

A Review of Aircraft.

IN connection with the visit of the Prince Regent of Bavaria to Berlin last week, a review of airships and aeroplanes was arranged at Johannisthal, and it had been hoped that the Kaiser would make a trip in the Naval Zeppelin. He, however, did not attend the review, but the Prince Regent of Bavaria spent a couple of hours inspecting the seven airships and sixty aeroplanes on parade.

February at Johannisthal.

DURING the month of February flying was possible at Johannisthal on 23 days, and the 69 pilots and 14 pupils on the ground made 2,373 flights, of a total duration of 254 hrs. 44 mins.

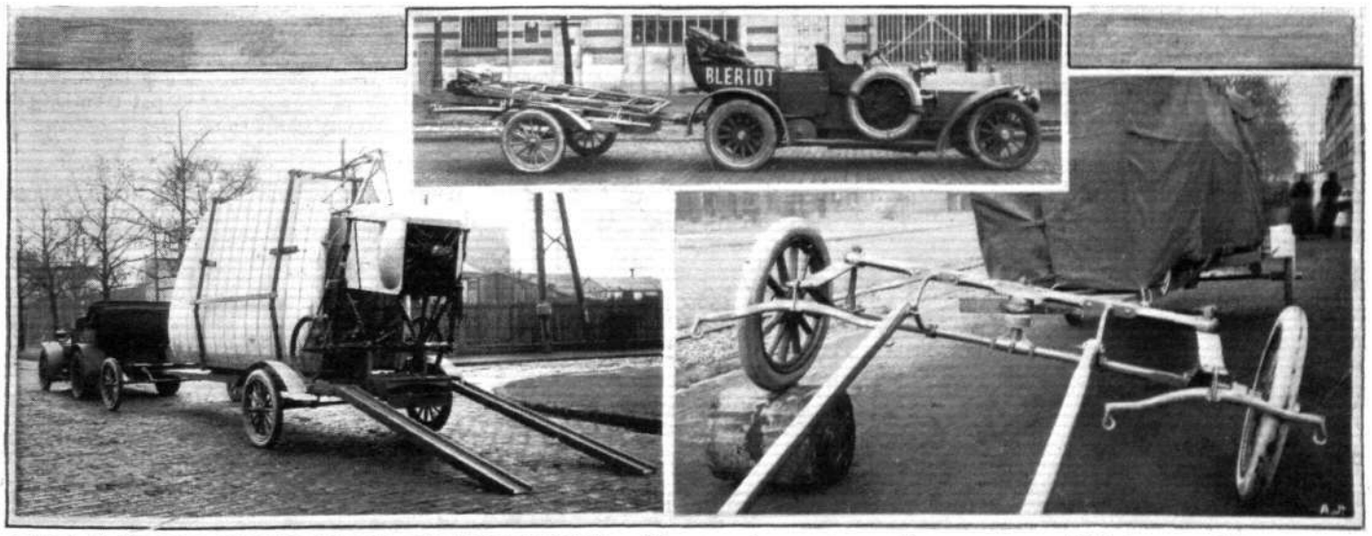
⊛ ⊛

Military Flying in Germany.

ON the 4th inst. Lieut. Braun and Schulz, the latter with Major Siefert as passenger, left Metz, and following the Moselle Valley landed at the Carthaus Ground at Coblentz after two hours' flying. After a short rest Lieut. Schulz went on to Cologne, his time for the 300 kiloms. from Metz to Cologne, including the stop at Coblentz being 5 hours.

Turkey Orders Aeroplanes.

IT is announced from Berlin that the Turkish Government has just placed with German firms orders for some 33 aeroplanes.



THE BLÉRIOT MONOPLANE TRANSPORTER.—The top picture shows the transporter folded up and in tow on a pair of its own wheels behind a car; that on the left illustrates the transporter in action, carrying a Blériot tandem two-seater monoplane. An idea of its construction can be gathered from the right-hand photograph, which shows how the transporter, which can be towed by means of horses or automobile, can be driven over obstacles without upsetting the balance of the monoplane on board.

The Royal Aero Club of the United Kingdom

OFFICIAL NOTICES TO MEMBERS

ANNUAL GENERAL MEETING.

The Annual General Meeting will be held at the Club Premises, 166, Piccadilly, London, W., on Wednesday, March 19th, 1913, at 4 o'clock.

AGENDA.

1. To elect Hon. President, Vice-Presidents and Council for the ensuing year. The following are recommended by the Committee for re-election :—

Hon. President: His Grace the Duke of Argyll, P.C., K.T., K.G., G.C.M.G., G.C.V.O. *Vice-Presidents:* Field-Marshal The Rt. Hon. Earl Roberts, K.G., K.P., V.C., G.C.B., G.C.S.I., G.C.I.E., O.M.; R. W. Wallace, K.C. *Council:* S.A.I. Prince Roland Bonaparte (President F.A.I.); H.S.H. Prince Blucher von Wahlstatt; His Grace the Duke of Sutherland, K.G.; The Rt. Hon. The Earl of Hardwicke; The Rt. Hon. The Earl of Lonsdale; The Rt. Hon. Lord Howard de Walden; The Rt. Hon. Lord Kinnaird, F.R.G.S.; The Rt. Hon. Lord Suffield, P.C., G.C.V.O., K.C.B.; The Rt. Hon. Lord Montagu of Beaulieu; Admiral The Rt. Hon. Sir Edward Seymour, P.C., G.C.B., O.M., G.C.V.O.; Admiral The Hon. Sir Edmund Fremantle, G.C.B., C.M.G.; Count Henry de la Vaulx (Vice-President Aero Club de France); Sir David Salomons, Bart.; Sir Norman Lockyer, K.C.B., F.R.S.; Professor Sir William Crookes, O.M., F.R.S.; Sir Hiram S. Maxim; The Rt. Rev. Bishop Welldon; Martin Dale.

2. To announce result of ballot for Committee.

3. To confirm rules.

[A set of new Club Rules will be submitted to the Members at the General Meeting for confirmation. The Committee do not propose to incur the expense of sending a print of the new rules to every member of the Club, but copies will be available at the meeting; and any member can obtain a print beforehand on application to the Secretary.]

Committee.

The following members have been proposed for the Committee :—

*Griffith Brewer.	Major F. Lindsay Lloyd.
Ernest C. Bucknall.	*F. K. McClean.
*Captain Bertram Dickson.	*Alec Ogilvie.
*John D. Dunville.	*Mervyn O'Gorman.
*Col. H. C. L. Holden, C.B., F.R.S.	*C. F. Pollock.
	Major B. Baden Powell.
*Prof. A. K. Huntington.	

The names of the retiring members of the Committee are indicated by an asterisk.

A ballot paper for the election of nine candidates to seats on the Committee of the Club has been sent to each member. Ballot papers must be received at the Club not later than 12 noon, Tuesday, 18th inst.

Committee Attendances during the Past Year.

Executive Committee. Meetings held, 24.

Griffith Brewer	21	Alec Ogilvie	18
Col. J. E. Capper, C.B., R.E.	6	Mervyn O'Gorman	7
G. B. Cockburn	20	C. F. Pollock	24
Capt. Bertram Dickson	8	Sir Charles D. Rose, Bart., M.P.	18
John Dunville	2	Com. C. R. Samson, R.N.	6
Major J. D. B. Fulton, R.F.A.	8	A. Mortimer Singer	9
Col. H. C. L. Holden, C.B., F.R.S.	15	Col. The Marquess of Tullibardine, M.V.O., D.S.O., M.P.	2
Prof. A. K. Huntington	18		
F. K. McClean	18	R. W. Wallace, K.C.	21
J. T. C. Moore-Brabazon	8		

Public Safety and Accidents Investigation Committee. Meetings held, 20.

A. E. Berriman	15	Alec Ogilvie	16
G. B. Cockburn	20	Mervyn O'Gorman	10
Major J. D. B. Fulton, R.F.A.	2	Sir Charles D. Rose, Bart., M.P.	2
Col. H. C. L. Holden, C.B., F.R.S.	20	Maj.-Gen. R. M. Ruck, C.B., R.E.	13
J. H. Ledeboer	6	Com. C. R. Samson, R.N.	3
F. K. McClean	11	Staff-Surgeon H.V.Wells, R.N.	3
W. O. Manning	13		

Competitions Committee. Meetings held, 7.

F. P. Armstrong	1	Major F. Lindsay Lloyd	6
E. C. Bucknall	6	F. K. McClean	5
G. B. Cockburn	6	J. T. C. Moore-Brabazon	3
Capt. A. E. Davidson, R.E.	3	N. C. Neill	4
Col. H. C. L. Holden, C.B., F.R.S.	6	Alec Ogilvie	5
		Mervyn O'Gorman	4
Prof. A. K. Huntington	5	E. V. Sassoon	5

Salisbury Plain Accident.

Immediately on receipt of the news of the fatal accident to Geoffrey England, while flying a Bristol monoplane at Salisbury Plain, on Wednesday, the 5th inst., the secretary proceeded to the scene of the accident. Major J. D. B. Fulton, and Major E. L. Gerrard, the Club's representatives on Salisbury Plain, who were already on the spot, made a careful inspection of the wrecked aircraft.

The following members of the Accidents Committee visited Salisbury Plain on Friday, the 7th inst. :—

Col. H. C. L. Holden, C.B., F.R.S., Mr. A. E. Berriman, Major J. D. B. Fulton, Major E. L. Gerrard, Mr. J. H. Ledeboer, Mr. F. K. McClean, Mr. Alec Ogilvie, Mr. Mervyn O'Gorman, Major-General R. M. Ruck, C.B., R.E., and Harold E. Perrin (Secretary).

A considerable time was spent in examining the wreckage which had been left untouched pending the Committee's investigation. The Committee afterwards held an inquiry at the George Hotel, Amesbury, and took the evidence of eye-witnesses. The representatives of the British and Colonial Aeroplane Co., Ltd., also attended before the Committee. The inquiry was adjourned till Wednesday, the 12th inst.

Monaco Hydro-Aeroplane Meeting.

The Monaco Hydro-Aeroplane Meeting will take place in April. M. Georges Prade, the organiser of the meeting, has written to Mr. Perrin, the Secretary of the Club, kindly offering special facilities to Members of the Royal Aero Club on presentation of a letter of introduction from him. Members who are going over to Monaco for the meeting are, therefore, requested to put themselves in communication with the Secretary of the Club.

International Aero Exhibition.

Class 4, Scale Models.—The Judges have made the following awards :—

1st Prize, £7	Charles Desoutter.
2nd Prize, £3	H. H. Ridley.
3rd Prize, £1	D. Stanger.

166, Piccadilly. HAROLD E. PERRIN, Secretary.

ROYAL FLYING CORPS (MILITARY WING).

WAR OFFICE Summary of work, week ending 8th March :—

No. 1 (Airship) Squadron.—A course of kiting has been begun this week, the wind having been very favourable for work with man-lifting kites. Monday and Tuesday were devoted to preliminary drills, without ascents, but on Wednesday, Thursday and Friday ascents were made, 40 being made in all on these three days.

No. 2 Squadron.—A high wind of 20-40 miles per hour blew incessantly throughout the week. Advantage was taken of this to overhaul thoroughly the 5 machines which arrived at Montrose by air. Major Burke has resumed command of the Squadron, and several other officers have rejoined from leave.

No. 3 Squadron.—The weather has been rather rough for flying during the week, the wind rising to 35 miles per hour every day. On Friday, experiments with signal rockets were carried out with BE and Maurice Farman machines. Certain alterations were made in Maurice Farman machine No. 214, and this machine was afterwards flown in a 30-mile wind on Wednesday, and found to behave very well. The men of the Squadron have shifted their quarters from Netheravon to Bulford.

No. 4 Squadron.—Owing to a good number of officers being absent at the Central Flying School for examination, only a limited amount of flying was done this week. The Breguet machines were out on several days, and tests were made with a view to recognising machines from the ground by distinguishing marks at different heights.

FLIGHT

FROM THE BRITISH FLYING GROUNDS.

Brooklands Aerodrome.

LAST Saturday all the schools were busy with pupils in the morning, but an increase in the velocity of the wind after lunch rendered instruction impossible. Just before dusk Mr. Raynham put the new Flanders tractor biplane through a satisfactory test, and it is anticipated that this machine will be tuned up in time to compete in the cross-country race on Easter Monday.

On Sunday the wind blew strongly all day long, increasing in violence towards the end of the day. No flying was possible in the morning, but in the afternoon Mr. Raynham was first out on the Coventry Ordnance tractor biplane, flying steadily in spite of the strong wind. Mr. Merriam was next out on the Bristol biplane, and after a short flight he was coming down when a sudden gust of wind caught his machine and everyone thought a bad smash was inevitable, when Mr. Merriam very cleverly righted it, and to everyone's great relief alighted in safety.

Two fine demonstrations were given by Mr. Hamel. So strong were the gusts that at times Mr. Hamel could only make about 15 miles an hour against them, whilst with the wind he easily reached a speed of 100 miles.

Bristol School.—No flying all day Monday, last week, wind being far too high.

On Tuesday wind was still too bad, and pupils busily occupied on machines in hangars.

No improvement in the weather on Wednesday, and outdoor work was not attempted.

Practically a gale was blowing all day on Thursday, and all thought of flying had to be abandoned.

On Friday it was not until 4 o'clock in the afternoon that Bendall was able to ascend for a test, taking Lieut. Morgan as passenger. Lieut. Robertson Dobie was up for a good solo, Bendall taking Lieut. Morgan on another machine. Lieut. Blatherwick was out alone, and put up a good show, making several circuits with right hand turns. Lieut. Robertson Dobie was also out and completed a couple of good circuits. Bendall giving tuition to Lieut. Morgan, darkness bringing flying to a close.

Bendall made a test at a very early hour on Saturday, with Lieut. Morgan, Lieut. Robertson Dobie out for a good solo, with right hand turns. Lieut. Blatherwick was also out and made several good figures of eight. Bendall was meanwhile with Lieut. Morgan, this pupil making good progress. Lieuts. Robertson Dobie and Blatherwick were both out for some really fine solos. Bendall giving Lieut. Morgan landing practice. High wind prevented further flying.

On Sunday, Merriam was out early as usual for a solo, then taking Lieuts. Duncan, Morgan, and Picton Warlow for tuition, instructing pupils in banking, left and right hand turns, and landings. Lieut. Blatherwick was out for a good solo, doing two very fine circuits.

Merriam was later passenger to Lieuts. Duncan, Morgan, and Picton Warlow for landing practice, all pupils doing well.

Wind was far too bad after breakfast. Merriam made a trial in the afternoon, but found the wind terribly gusty.

Vickers School.—Tuesday last week, Major Cameron on No. 3 mono. doing straights in wind up to 20 m.p.h. Next day Mr. Barnwell out on biplane early in the morning testing extensions fitted. Too windy for pupils. On Friday, Barnwell flying biplane before breakfast, but too windy for pupils, who had wisely stayed in bed. In the afternoon, Barnwell on Farman for test flight, then with Mr. Knight, a new pupil, then with Mr. Waterfall, another new pupil. Mr. Knight then went out on No. 3 mono. taxying, and had the misfortune to break a propeller. Barnwell then took Mr. Waterfall for straights on biplane and afterwards Mr. Knight. Knight, the other pilot, then took charge taking Mr. Waterfall, and afterwards his namesake Mr. Knight for further tuition.

Saturday, Barnwell out early with Messrs. Waterfall and Knight giving place when nearly frozen to Knight, who took the pupils till he in turn was down to zero. Barnwell out again till too bumpy for pupils.

London Aerodrome, Collindale Avenue, Hendon.

Grahame-White School.—During practically the whole of the past week the weather was so bad, with strong winds and heavy rain, that it was impossible for any school work to be done. On Friday, the 7th, Mr. Louis Noel was out on the 80-h.p. Farman, followed later by Mr. Manton on No. 5 machine. On Saturday, at 7.30 a.m., Mr. Manton on No. 7, Mr. Cheeseman on No. 5, and Mr. Louis Noel all out doing circuits.

Blackburn School.—On Saturday morning last, early, Mr. Blackburn made a test flight, Mr. Spink afterwards taking the machine for circuits.

On Sunday, after a test flight by Mr. N. Blackburn at 7.45 a.m., Mr. Spink had 20 mins. practice.

Blériot School.—The first four days of last week were too windy to permit of any school work being done outside the sheds, but the staff were very busy adjusting machines in anticipation of being able to resume work at an early date. School machine No. 5 had the 50-h.p. Gnome engine taken down for cleaning ready for the superior *brevet* pupils on the books, and as soon as the wind drops there should be a small crop of *brevets*. M. Gandillon is practically ready for his, and Mr. Clappen will be going aloft for his, given a few more flying days.

On Friday, Lieut. Loftus Bryan was out doing very nice straights on No. 1, and is making excellent progress. Mr. Williams has progressed to the more interesting stage wherein he does very nice rolls with the tail well up, and will soon be doing straight flights.

The following day was really too windy for school work, but during a temporary lull in the morning M. R. Desoutter managed to put in a straight flight.

W. H. Ewen School.—There have not been many opportunities for pupils' work during the past week, but although they were only out on two days a surprising amount of flying practice was put in.

The earlier part of the week was very boisterous, but on Wednesday, notwithstanding a very strong wind, Mr. Lewis Turner was doing some fine flying on the 60-h.p. Caudron. Mr. Turner was again out on the Friday on the same machine.

Mr. F. Warren Merriam, with Lieut. Picton Warlow—a pupil—as passenger, making a flight in one of the Bristol biplanes at Brooklands. Mr. Merriam is descending from 2,000 ft. with engine off, the propeller, it will be noted, having stopped.

It was not till Saturday that the pupils were out, but, starting at 6.50 a.m., a glorious morning of practice was put in. After the test flight by Mr. Turner on a 35-h.p. Caudron, Lieut. Bayly took over the machine and did some excellent circuits and figures of eight, handling the machine in a confident manner and making splendid landings. M. Baumann was also on the 28-h.p. Caudron, on which machine he was instructing Lieut. Usborne and Messrs. Stewart and Torr, all of whom were making nice straight flights. Later on the wind rose, and Mr. Turner was doing exhibitions on the 60-h.p. Caudron.

The pupils were out again on Sunday at 7 a.m., and some good flying was put in. The feature of the day, however, was the gaining of two *brevets* on the little 35-h.p. Caudron. After the test flight by the chief pilot of the school, Lieut. Bayly started off

on the *brevet* Caudron, and successfully accomplished the tests for his R.Ae.C. certificate. Flying at an average altitude of 400 ft., he made beautifully-judged landings after both flights. Immediately after, Mr. Lawford started off on the same machine, and was also successful in completing his *brevet* tests, flying confidently at 250 ft., and landing beautifully on the mark. Soon after the wind rose, and put an end to school work for the day. M. Baumann was out later, making a very nice exhibition flight on the 35-h.p. Caudron.

British Deperdussin School.—Monday, Tuesday and Wednesday last week, blowing hard, no school work.

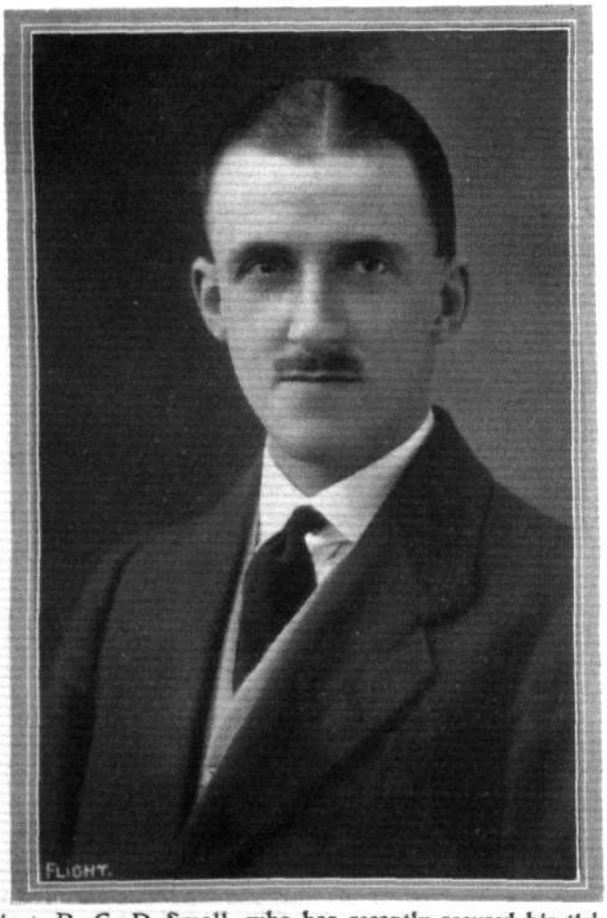
Thursday, Mr. E. B. Bauman (new pupil) joined school, and had his first lesson on No. 2 taxi. Wind too strong to go out.

At 11.45 a.m. Friday, after a few preliminary circuits, Mr. Gordon Bell started with passenger to Eastchurch on new 80-h.p. Dep. ordered by Admiralty. He did the journey in 40 mins. A good performance considering wind was against him most of the way. Mr. Spratt and Mr. Whitehouse out for circuits about ½ hour each on No. 4 machine in evening. Wind too much for other pupils.

Lieut. Hordern flew a preliminary circuit and figure of eight at 7 a.m., Saturday, then went for *brevet* tests, passing in good style, keeping a steady altitude of 200 ft. throughout. Landings very good within 10 yards of observers. Second half the wind got up and was very bumpy.

Monday, Mr. Spratt circuits 10 mins. on No. 4 (testing). Mr. Valazzi circuits 20 mins., and later 10 mins. on same machine. Mr. Bauman rolling on No. 2 taxi 10 mins. Mr. Phelps, straights, showing improvement on No. 3 *brevet* machine, 40 mins.

Temple School.—On Wednesday, last week, Mr. George L. Temple gave instruction in controls to Mr. D. Ritchie and Mr. R. Penny. Next day work was confined to hangar, weather being too rough for pupils, Mr. G. Temple later giving a short exhibition flight on the Caudron biplane. All Friday a bad wind prevailed, Mr. Temple making two excellent flights, going out across country. Saturday morning at 7 a.m., R. Penny 10 mins. rolling on Blériot No. 2. In the afternoon, George Temple made a fine flight on the 35-h.p. Caudron, being caught by a terrific gust of wind and tossed about in a most alarming way, eventually effecting a safe landing with great difficulty. Monday, at 11 a.m., under the supervision of Mr. Temple, on Blériot No. 2, Messrs. Ritchie and Penny rolling. Mr. Temple later tested Blériot and gave Mr. A. Vaile first lesson in controls. In afternoon Mr. Temple out on Caudron, taking his father for two passenger flights and later solo for 16 mins., finishing with a splendid *vol plané*.



Lieut. R. G. D. Small, who has recently secured his ticket at the Grahame-White Aviation School.

Mr. Jules Teulade-Cabanes, a pupil who has recently taken his *brevet* in good style at the Blériot School at Hendon.

Salisbury Plain.

Bristol School.—An absolute gale was blowing all day Monday last week, and flying was quite out of the question.

On Tuesday wind with occasional showers of rain prevented any attempt at flying, and instructions were carried on in the hangars.

No flying in the early part of the morning on Wednesday. About noon England went out on a monoplane for a flight which, as reported elsewhere, ended fatally.

No flying all day on Thursday. On Friday, no flying until evening, Jullerot made a solo in an 80-h.p. Bristol monoplane, and then took Lieuts. Griffiths and Brodribb for tuition in a biplane, but darkness prevented further work. Very windy all day on Saturday, and flying was impossible.

Royal Flying Corps.—Wednesday of last week being fine, Major Higgins, D.S.O., was out on BE 203, and did some signalling while flying around the Plains at a height of 2,000 ft. Lieut. Cholmondeley out on M. Farman 214, with Lieut. Carmichael as passenger, went over to the Central Flying School, Upavon, and back at a good height. No out-door work was possible on Thursday as the winds were very treacherous.

Friday, windy and cloudy. Major Higgins out on BE 203, followed by Lieut. Cholmondeley on M. Farman 214, scouting around the Plains at a height of 2,000 ft. Lieut. Cholmondeley on M. Farman 214 made several flights, also with Lieut. Carmichael as passenger, to Salisbury and back. On returning took Lieut. Carmichael for experimental signalling from a great height, which apparently gave good results. Major Higgins also was out on BE 203, taking up Capt. Allen as passenger for 1 hour's flight, getting to a height of 4,000 ft., observing coloured rockets which were sent up to 3,000 ft. by officers on ground. Four machines, 3 M. Farmans and 1 Avro, came over from the Central Flying School at Upavon to watch the signalling. Saturday and Monday, work confined to sheds. On Tuesday, Lieut. Carmichael and Lieut. Anderson made good flights on M. Farman 214. Lieut. Cholmondeley out on M. Farman 216, scouting around the downs with air mechanics.

⊛ ⊛ ⊛ ⊛

Delivering a Caudron by Air.

ON a Caudron biplane with Gnome motor, ordered by the British Admiralty, M. Marty, accompanied by Mr. A. Ramsay, left Issy on Friday week intending to fly to the W. H. Ewen Aviation Co's. headquarters at Hendon. They made stops at Rouen and Crotoy, and at the latter place found the fog so thick that to cross the Channel was out of the question. On Sunday afternoon the Channel was crossed and the aviators flew to Adisham, near Dover, where they landed. There the police, under the regulations of the Aerial Navigation Act, took full particulars of the travellers who resumed their journey. At Bekesbourne, near Canterbury, engine trouble necessitated another descent.

FLYING AT HENDON.

THE March winds made a determined attempt to prevent any flying from taking place at Hendon on Saturday last, but without success. By way of a threat, an extraordinary gust of wind, which was also experienced in other parts of the country, swept the aerodrome shortly after noon. It lasted for quite 15 minutes, and was so strong that No. 1 pylon was blown completely over. Fortunately there was no machine out at the time, for had there been there would have been but little hope for it. The suddenness and force of this gust is recorded in a graphic manner by the wind chart at the aerodrome. Just before the gust the line—which had been at 10 m.p.h.—fell to about 8 m.p.h., then suddenly rose to 40 and immediately dropped a little, only to make another jump to 40 m.p.h. After this, it gradually settled down to only a few miles an hour, whereupon two old friends —Louis Noel and the 80-h.p. Henry Farman biplane—made their appearance and demonstrated that Mr. Wind was not going to have it all his own way. Noel, who seems to be very much the better for his trip to Switzerland, was followed by Marcus D. Manton on the Grahame-White 'bus, and Marcel Desoutter on the Blériot monoplane, whilst Pierre Verrier took up a lady passenger on the Maurice Farman biplane and gave a very fine exhibition of flying. Noel then made another flight on the "eighty," and Lewis Turner brought out the 60-h.p. Anzani-Caudron biplane and put up a few circuits. Verrier was also out again with passengers. Towards the end of the afternoon another gust of wind made its appearance while Noel, on the Farman, and George Temple, on his 35-h.p. Caudron, were making flights. Both had some difficulty in fighting against the wind, but eventually came out victors.

On Sunday the wind was blowing in gusts of about from 15 to 40 m.p.h., so very little flying was done. However, some interesting flights were witnessed, for M. Renaux paid a visit to the Aircraft Co.'s hangars, and also made a flight on one of the Maurice Farman biplanes, taking with him Mr. Holt Thomas as passenger. Verrier was also out on the same machine, and Louis Noel flew the 80-h.p. Henry Farman, but otherwise it was too windy for any of the other machines to go out.

Tube and 'Bus Maps for Hendon.

THE enterprise of the proprietors of the London Aerodrome is shown by the fact that special editions of the maps published by the Underground railway and the London General Omnibus Co. have been produced, showing how easy it is to get to the flying ground at Hendon. Those who intend visiting the aerodrome should make a point of getting copies of these maps.

Easter at Hendon.

THERE will be practically a four days' meeting at the London Aerodrome, Hendon, during the Easter Holidays, as although there will be no competitive events on the Sunday, there will be special exhibition and passenger flights. There will be a speed handicap on Good Friday as well as a cross-country handicap to Elstree and back twice, a distance of about 16 miles, while on Saturday the programme will include a speed handicap and an altitude contest. For Easter Monday a cross-country handicap twice round a triangular course, making a distance of 18 miles, has been arranged, while the second important item will be a speed handicap for which the *Daily Express* is giving cash prizes value 100 guineas. In addition there will be exhibition and passenger flights, and arrangements for the latter can be booked either on the ground or at the London Offices, 166, Piccadilly, W.

⊛ ⊛

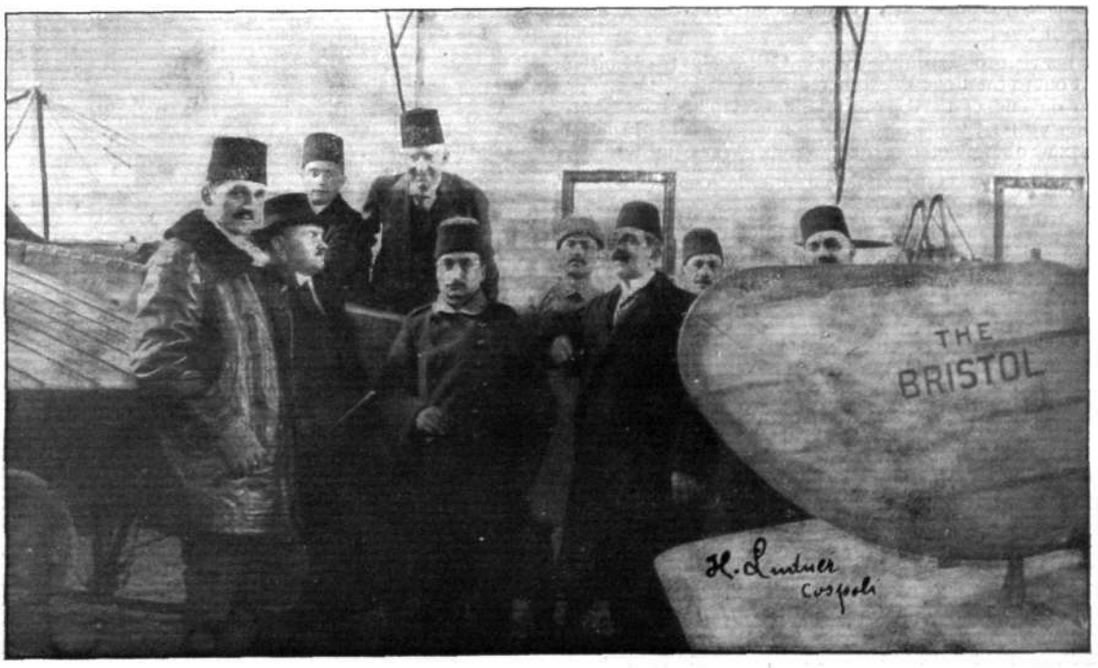
The Salisbury Plain Catastrophe.

WE were able, in our last issue, to briefly record the untimely death of Mr. Geoffrey England on Salisbury Plain, and we would offer our deepest sympathy to his brother, Mr. Gordon England, and the other members of the family. A statement made at the inquest—at which a verdict of accidental death was returned—seems to have created in some minds an impression that undue influence is brought to bear to induce pilots to fly, however bad the weather may be, but such an idea, at any rate so far as the Bristol Co. or any other firm in Great Britain is concerned, is entirely erroneous. Naturally, experienced pilots are at all times anxious to demonstrate the flying qualities of their machines, and on occasions they may be allowed to go up if they so wish when the risks would be too great for a less qualified pilot to undertake. So far from any compulsion being used in the present instance, we understand that the unfortunate pilot actually volunteered to take the machine for the test which terminated fatally.

⊛ ⊛

The Navy's Borel Hydro.

THE reception tests of the Borel hydro-aeroplane, purchased by the Admiralty at the Olympia Show, were carried out at the Isle of Grain on Tuesday morning. Chemet being the pilot and Lieut. Seddon the official observer. The wind ranged between 25 and 35 m.p.h., thus affording a good test of the capabilities of the machine which, with a 3½ hours' supply of fuel and oil, carried out the hour's flight and the climbing tests to the complete satisfaction of the authorities. Although the surface of the water was none too smooth, mainly due to the wind, this did not affect the machine in the several rising and alighting trials which were made. During the speed tests there was a cross wind, but a speed of between 62 and 65 m.p.h. was attained. We understand from Messrs. Delacombe and Maréchal, who have the agency for Borel machines in Great Britain, that another machine of similar type has been ordered by the Admiralty and it is to be delivered next week.



THE BRISTOLS IN TURKEY.—A gathering of several high personages of State after inspection of a couple of Bristols supplied to the Turkish Government.

BRITISH NOTES OF THE WEEK.

ROYAL FLYING CORPS.

THE following appointment was announced in the *London Gazette* of the 11th inst. :—

R.F.C.—Military Wing.—Lieut. Frederick A. Wanklyn, Royal Artillery, to be a flying officer, and to be seconded. Dated November 28th, 1912.

Heavy Weather at Montrose.

SINCE the arrival of the Royal Flying Corps at Montrose they have been treated to anything but ideal flying weather, and last week the conditions were so boisterous that flying was out of the question. Some little excitement was caused on Wednesday night by one of the hangars being blown down, but as it was empty no great damage was done.

Dublin's Aerodrome Nearly Ready.

IT is hoped that the aerodrome which is being laid out at Inchicore to the west of Dublin will be so far ready that flights may be made during Easter week. Two Farman biplanes and a Blériot monoplane are, we understand, already on the ground. It is proposed to run the aerodrome on the lines of the London aerodrome at Hendon, which have proved so successful.

Signalling to Aircraft.

IN view of the provisions in the Home Office regulations regarding the necessity of an aircraft to land on being signalled to, experiments were made at Larkhill and South Farnborough on Friday of last week in the firing of signal-rockets to warn air-craft that they are approaching a prohibited area. The object of the experiments is to ascertain what form of rocket is most suitable for use both by day and by night.

Design and Construction of Aeroplanes.

ON Monday, the 3rd inst., a paper on this subject was read by Mr. Malcolm B. Ross, before the Polytechnic Engineering Society, Regent Street. Mr. Ross illustrated his paper by a comprehensive set of lantern slides, and dealt with all the vital parts of the aeroplane in a thorough manner. The paper was greatly appreciated by a large audience, and at the general meeting of the Society last Monday, Mr. Ross was awarded the diploma for the best paper read during the term.

Newcastle to Present an Aeroplane.

UNDER the patronage of the Lord Mayor of Newcastle-on-Tyne, a fund has been opened with the object of presenting one or more aeroplanes to the War Office. The fund has been started with a contribution of £53 from the proceeds of the flying meeting at Gosforth Park, last Saturday. Subscriptions may be sent to Mr. Norman Sinclair, 31, Sanderson Road, Newcastle-on-Tyne, or to Mr. Robert Ellis, 40, Dean Street, Newcastle-on-Tyne.

Col. Seely in the Air.

DURING his visit to Madrid last week, Col. Seely, the Minister for War, went out to the Four Winds aerodrome and was taken for a 14 min. trip on one of the Spanish military biplanes by Capt. Barron. Other visitors, who also ventured aloft, were the Princess Beatrice of Saxe-Coburg-Gotha and the Spanish War Minister.

The Navy League at Work.

AT a conference called by the Navy League, presided over by Mr. Robert Yerburgh, M.P., held on the 5th inst., a special committee was formed to deal with the subject of aerial defence. The committee subsequently passed a resolution asking the Treasury to grant a vote of £1,000,000 to the Royal Flying Corps to be expended as follows :—

"(*a*) For the immediate provision of adequate airship stations and airships in proper strategical positions.

"(*b*) For the construction or purchase of a sufficient number of efficient and practical aeroplanes.

"(*c*) To bring the Royal Flying Corps immediately up to the full strength of its establishment in respect to personnel, with the necessary sheds, grounds, barracks, transport, and repair facilities.

"(*d*) For further and sufficient provision for the proper training of pilots."

A second resolution to the following effect was also passed :—

"That this committee, with all due deference to His Majesty's Government, wish to place on record an expression of their surprise at the undignified publication of printed rules for the conduct of foreign airships and aeroplanes under the provisions of the Aerial Navigation Act, having regard to the fact that, owing to the neglect of the Government, Great Britain is impotent, at the present time, to meet the menace of aerial aggression with weapons more efficient than mere words."

A Naval Station at Yarmouth.

A PIECE of land about five acres in extent on the South Denes, near the Harbour mouth at Great Yarmouth, has been leased by the Admiralty from the Town Council. It is proposed to establish a naval air station at the point, with a staff of two officers and about twenty men.

The Thames Disaster.

THE body of Harry England, who was drowned with Leslie MacDonald when the latter's aeroplane fell into the Thames on January 9th, was recovered on Friday week off Grays, and at the inquest on the following day a verdict of accidental death was returned.

Col. Cody and His Methods.

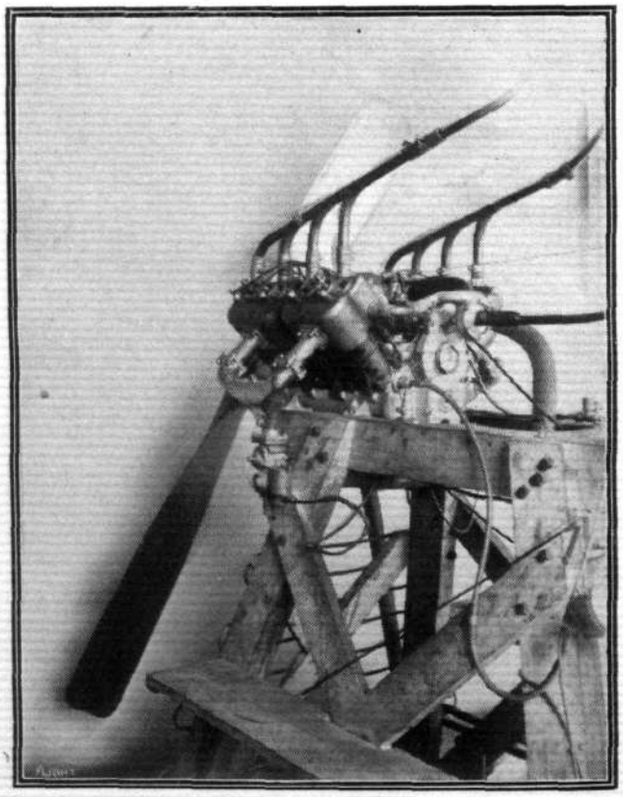
ON Tuesday next at 8 p.m., Col. Cody is to lecture before the Institute of Inventors, at 20, High Holborn, W.C., taking as his subject, "My Method of Aeroplane Construction, and how I obtained recognition."

Mr. Corbett Wilson at Biarritz.

FLYING against an adverse wind, Mr. Corbett Wilson on the 6th inst. flew on his Blériot from Pau to Biarritz, passing along the Gave and Adour valleys. The journey, despite the unfavourable conditions, took about an hour.

The Sunbeam Aviation Engine.

IN the aviation engine, built by the Sunbeam Co., which has been under test since last Christmas, the designer, Mr. Louis Coatalen, has striven to obtain a reliable motor, which it would be easy for any motor car mechanic to overhaul when necessary. As will be seen from the accompanying photograph, the aviation engine is an eight cylinder, 80 bore, 150 stroke, with the cylinders disposed in "V" formation, at an angle of 90 degrees. The cylinders are duplicates of those on the three litre Sunbeam engine, which did so well in the Coupe de *l'Auto* race at Dieppe, and they are made of cast iron with copper water jackets. As the two groups of cylinders are in the same plane, there are only eight cams to operate the sixteen valves. The propeller is driven through a reduction gear of two to one. At 2,500 revolutions the engine gives 150-h.p., and as the weight of the engine complete with carburettor is 425 lbs., this works out to 1-h.p. for less than 3 lbs. weight. The petrol consumption is given as 42 litres per hour. Lubrication is forced by gear pump submerged in the oil in the bottom half of crank-case.



The Sunbeam aviation engine designed by Mr. Louis Coatalen. With eight cylinders, 80 mm. bore by 150 mm. stroke, it gives 150-h.p. at 2,500 revs. per min.

FLIGHT

FOREIGN AVIATION NEWS.

A New Height Record.

GARROS' splendid height record of 5,610 metres has only stood for three months, and on Tuesday the honour was once again placed to the credit of the Blériot monoplane, this time by Perreyon, the *chef pilot* of the Blériot school at Buc. During a flight which lasted an hour and seven minutes he got up to a height which is reported as 5,850 metres (19,300 ft.).

Aerotechnics in France.

A SPECIAL grant has been made by the French Parliament to the Paris University for the Aerotechnic Institute at St. Cyr. The money is to be spent on a dynamometer, an electric testing apparatus for propellers and a powerful wind tunnel.

The Latham Memorial.

HAVING received subscriptions totalling to about £800, the committee in charge of the proposed memorial to Hubert Latham is now considering the actual form which the memorial shall take. It is to be erected in the neighbourhood of Sangatte where Latham started on his several valiant but unsuccessful attempts to fly the English Channel.

Good Flying by Dick Farman.

ON Monday, Dick Farman made a flight of over an hour's duration on a Maurice Farman biplane at Buc, passing along the Chevreuse Valley and over Trappes and St. Cyr. Henry Farman and Fischer were busy testing the hydro-aeroplane which it is proposed to send to the Monaco meeting.

Fast Flying on Deperdussins.

DURING a trip from Rheims to Vouziers and from Vouziers to Mouzon on the 5th inst., Lieut. Redelsperger on a Deperdussin-Gnome averaged a speed of 115 kiloms an hour.

Last Year's Military Flying in France.

IT has been calculated that during last year the French military pilots covered a total distance of 507,900 kiloms. The number of machines used was 290, so that the average per machine was 1,750 kiloms. The number of cross-country flights by military aviators last year is given as 2,380.

More Deperdussin Superior Pilots.

DURING last week three of the military pupils at the Deperdussin school at Betheny secured military *brevets*. Capts. Fabre and Delagarde, qualifying at the beginning of the week, while on the 6th inst. Lieut. Redelsperger completed the tests by flying from Rheims to Vouziers, then on to Mailly Camp and back to Rheims, his average altitude being 2,000 metres.

Fine Work on Caudrons.

FROM the Caudron school at Crotoy on the 6th inst., Galtier carried out a trip of three hours' duration across country, while Marty, in view of his projected trip to London, was flying for two hours on a biplane with six-cylinder Anzani engine and eventually landed at Longpre.

The Farman Sunday Trips.

THE habit of Maurice Farman of making a cross-country trip every Sunday seems to be likely to be followed by other Farman pilots. On Sunday Maurice Farman and Barbaroux, each with a passenger, paid a visit to Etampes from Buc, while Combette went from Etampes to Orleans, and Fourney took a Maurice Farman machine over from Etampes to St. Cyr.

A Nieuport for Japan.

ON the 8th inst. a Japanese military commission visited Villacoublay and witnessed tests with a Nieuport, piloted by Mandelli, built to the order of the Japanese Government.

Fast Trip from Paris to Lyon.

ON a Morane-Saulnier monoplane with 50-h.p. Rhone motor, Gilbert flew on Sunday from Paris to Nevers in an hour and three quarters, and after half-an-hour's rest completed the trip to Lyon in another 1¾ hours, so that his flying time for the distance of 512 kiloms was 3½ hours. The fastest train on the railway takes 6 hrs. 13 mins. from Paris to Lyon. On Monday, Gilbert went from Lyon to Amberieu and back.

French Mobilisation Test.

WITH a view to testing the organisation of the French Army Aeronautic Corps, an order was sent on the evening of the 3rd inst. to the station at Belfort that an escadrille of Blériot monoplanes was to be sent with all equipment on the following morning to Mailly Camp. The order was duly carried out the next morning, the six monoplanes being piloted by Lieuts. Jacquet, Boucher, Gaubert and Tretarre, Sergt. Caron and Sapper Blaignan. The procession of motor vehicles, &c., in attendance made a most impressive spectacle when arriving at Mailly.

Another Prize for Aviettes.

M. BERNARD J. DUBOS has just offered a prize of £40, which will be awarded to the aviette with beating wings which accomplishes the fastest kilom. over 24 k.p.h. on the Parc des Princes Track before June 30th.

Flying from Nice to Rome.

ON the 4th inst., Laurens on his Deperdussin hydravion started from Nice with M. Jacques Schneider with the intention of flying along the coast to Rome. The first stop was at Spotorna, near Savonne, for petrol, and in alighting on the water, the floats were slightly damaged. Repairs were executed and the journey resumed at 4 p.m. Genoa was reached at 5.20 p.m., and the net flying time for the 170 kiloms. from Nice was given as 1 hr. 52 mins.

Good Work by Clerget Motor.

SOME fine flying has been done at Rheims recently by Capt. Aubry on a Deperdussin monoplane fitted with a 60-h.p. Clerget rotary motor, and on Monday a long cross-country trial was made in splendid style. Similar motors are being used with equally good results by Duval on a Deperdussin monoplane, and Gobe on a Nieuport.

An Aeroplane for North Pole.

THE French expedition, which, under the leadership of M. Jules Payer, will leave Havre in June for research work in the North Polar regions, is to include aeroplanes among its equipment, and the Minister of War has been asked to permit Lieut. Menard to accompany the expedition as pilot.

The Paris to Milan Trip.

LETORT, who left Issy on Monday week on a Sommer-Rhone monoplane with the intention of flying to Milan, had to stop at Nevers owing to his petrol giving out. The next day he went on to Lyon, and on the 5th inst. he arrived at Amberieu.

Long Trip by Legagneux.

LEAVING Villacoublay at 3.40 p.m. on Sunday on a Rhone-engined Morane-Saulnier monoplane, Legagneux arrived at Auxerre at 5 o'clock. The next morning he re-started, and after making a stop at Chalons-sur-Saone for lunch, went on to Lyon, where he had an appointment to test a military machine.

Paris to Lyon in a Day.

AMONG the several trips made recently from Paris to Lyon, perhaps the finest was that made on Sunday by Edouard Martin, a director of the Société Le Rhone. On a H. Farman with Rhone motor, he started from Etampes, and at 10.30 landed at Moulins. Starting again at mid-day, he was forced to land on account of the cold after an hour and a half's flying at La Clayette. At 5 p.m. he was again in the air, and was able to complete the 500 kilom. trip to Lyon before nightfall.

Long Trip by Audemars.

ON a Morane-Saulnier monoplane, Audemars, on the 4th inst., flew from Bale to Geneva, a distance of about 200 kiloms., in 2 hrs. 10 mins.

Mourmelon to Berne on a Hanriot.

ON the 5th inst. Favre arrived at Berne on his Hanriot monoplane, on which he had made the journey from Mourmelon, with stops at Metz, Bale and Neuveville. The authorities at Metz, after enquiries as to his intentions, permitted the aviator to continue his journey, instead of insisting on him returning to France by train.

Flying from Biskra to Tunis.

THE four Henry Farman biplanes completed their 1,200 kilom. journey from Biskra to Tunis on the 3rd inst. Sergt. Hurard who had been held up by the bad weather at Enfidaville was the first to arrive, and he was closely followed by Lieut. Cheutin. Lieut. Reimbert arrived from Grombalia at 9 o'clock, while Lieut. Jolain flew on from Boufisha to Grombalia in the morning and completed the trip to Tunis during the afternoon.

Enver Bey in the Air.

FROM Constantinople it is reported that Enver Bey, the leader of the Young Turks, determined to obtain first-hand information as to the disposition of the Bulgarian troops along the Tchatalja lines, has been making trips on an aeroplane in charge of a German pilot.

Deperdussins in Algeria.

UNDER adverse conditions a fine flight from Oudjda to Merada Camp was made on the 6th inst., by Lieuts. Magnien and Jeannerod, the former being accompanied by a passenger, on Deperdussin monoplanes. Throughout the trip of an hour and a half a height of 800 metres was maintained.

STABILITY DEVICES.

By MERVYN O'GORMAN.

(*Concluded from page 293.*)

60. Other simplifications and premises such as the absence of any movement of the centre of pressure on a wing with variation of attitude were made, and even in these circumstances the mathematical treatment became sufficiently abstruse. What it would have been with true aerofoil conditions if the ambient air were supposed to be horizontally gusty according to a complex law is difficult to imagine, but in the event of there being not only horizontal, but also vertical gusts, of the kind indicated in paragraph 10 the treatment would doubtless be beyond human ken to-day. Yet this is the practical problem we are out to solve. For the present Bryan's simplifications must be of great use to us if only as a guide to thought—just as the hydro-aeroplane must be first studied in the simplified conditions of calm water before it is modified to suit a rough sea.

Horizontality Maintenance by Flaps.—Wildeblood's invention (11334, May 7, 1910) is an excellent example of the difficulty so recurrent in flying work that what is a safeguard against disturbance by side-gusts provides a danger in the event of side-slip.

The idea is original. The flaps face inwards and hinge on their outer edges when a side gust comes, as shown in Fig. 15, tending to raise the left wing; it moves ineffectually over the left flap and meeting the right flap raises it and so puts it into an attitude to give a strong lift by suitable shaping, the upward pressure under the right flap so obtained is equal to the extra lift under the left wing, and balance is maintained.

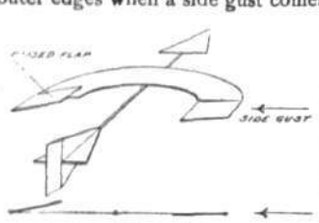


Fig. 15.

If, however, side-slip occurs towards the left side the right flap is raised and catches the air as before, thereby precipitating the catastrophe by increasing the lateral slope. Mr. Wildeblood's models are so very successful that I should like to know more about them than is disclosed by his patent before pronouncing on them.

Model Tests.—Model gliders, on which an engine failure and consequent stalling is not to be feared with its resultant side-slip, may quite well be expected to perform with this arrangement for the large majority of flights, particularly since voluntary steering with its attendant side-slipping and unbalanced lifts to the wings is also eliminated.

Nevertheless, even in a glider, it should be possible to show that provision has not inadvertently been made, which inevitably secures the anti-banking effect on side-slipping. If the spiral nose-dive is claimed as one of the steps towards recovery of flight speed and eventual resumption of horizontal flight with the device, this may under some circumstances be admitted, but it implies that which does not always occur in real life, namely, that there is always plenty of space below to give the time for recovery.

Unfortunately with models intended to show the merits of particular devices, though the model may succeed, it is not always due to the device displayed but to other incidents which are not made so obvious in the demonstration—fin areas, upturned wing tips, stiff movement of balancing flaps, abnormally light loading in relation to wind characteristics, unusual head resistance, or head resistance distribution, &c. &c. Therefore deductions from successful models must be made with great circumspection, and indeed I am strongly in favour of the construction of full-size "models" sent up without pilot over some large piece of water for the study of safety dodges.

61. **Gyroscopes.**—This subject was dealt with at length by Mr. W. T. K. Clarke, at present on the staff of the R.A.F. in a recent paper before the Society. It is not suitable for a corner in a long paper. I will only touch on it briefly. A large gyroscope rotating (not as the Gnome usually does, axially with the aeroplane, but running as if it were a wheel running forward) will tend to maintain horizontality against lateral rolling, because it will tend to advance the wing which is lowered—this tendency, if encouraged, will give it extra lift. This applies to both wings, and so far we have the germ of a device. It has no effect on pitching. If, however, we try to bank it will oppose itself thereto, a matter of no great moment since we can easily overpower it. The chief objection would seem to be that it will tend to maintain any banked attitude once it has been reached, including dangerous banks on to which we may be thrown by a strong gust.

62. There are two matters of interest in connection with gyroscopes of the dimensions of the 100 Gnome engine; one is to know what is the order of magnitude of the gyrostatic couple; the other is to realise that the gyrostatic couple vanishes as soon as the aeroplane begins to yield at the rate called for by the precession.

This second fact is almost always ignored by the vague inventor, of whom there are so many, and who count on a continuance of the effect until the righting is achieved.

For all this, it is useful to have the results of calculation and experiments which were made for a different purpose, and which show the disturbing effect of a 100 Gnome engine and propeller, together under legitimate but extreme conditions of quick diving and quick turning.

63. This work showed that:—

a. The gyrostatic effect of the propeller alone is a trifle greater than that of the Gnome engine which drives it, say as 184 lbs. ft. is to 140 lbs. ft. when the rate of diving or turning is one-third of a radian per second.

b. It is unnecessary to make the two effects additive, since by the simple expedient of gearing them in opposite directions the couple can be reduced to insignificant dimensions.

c. The gyro effect of even 100-h.p. Gnome is not nearly as important as often supposed, and can be countered by elevator and warp movements of small dimensions even when turns and dips of considerable sharpness are executed.

d. The developing of a large gyro couple can be caused only by trick flying of a kind in any case to be discountenanced.

e. The total gyro effect of engine and propeller together in the above case is 324 lbs. ft. for turning by ruddering one revolution in 20 seconds.

f. The total gyro effect of engine and propeller is 330 lbs. ft. for turning down by elevator at the fast rate which would relieve the pilot of any sensation of weight on his seat in a 60-h.p. aeroplane.

Even these maximum couples are well within the controls. They give just the same sensation and call for the same correction as gusts of moderate force, for which the flyer must in any case be prepared.

General Methods.—*Toussaint and Lepère*, having evolved a velometer (July, 1912) using a Pitot tube, propose to employ the diaphragm of the recorder to control the elevator through a relay. This would put their device into the class "Speed maintainers," but they combine with it a lateral balance apparatus. They pierce a number of holes in the upper and lower parts of the wings, fit these holes with tubes carrying the algebraic totalised pressure difference between one wing and the other to a diaphragm which actuates a lever which in turn operates electric relays (or alternating pneumatic relays) to warp the wings. The elaboration is very great and it does not appear clearly that the simpler methods of balancing wing pressure, &c., are not at least equally good—at any rate, what the authors achieve is not "the automatic stabilisation" indicated in the title given to the description.

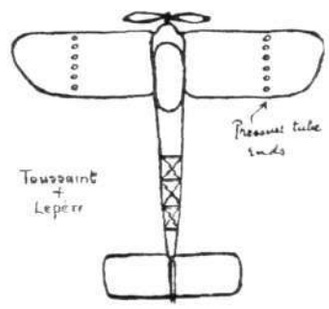


Fig. 16.

Anticipating the Disturbance.—I venture with some diffidence upon a device of my own relating to soaring but bearing on this subject. Whatever disturbance an aeroplane is suffering from, its rectification inevitably takes time, during which the machine covers an amount of space which may cause a critical situation. Accordingly, therefore, we must seek for prevention rather than cure. The human operation of the controls to outvie the effect of gusts is never more than a cure. Man cannot feel the velocity of his movements, nor even an acceleration, but he is extraordinarily sensitive to a change of acceleration. Witness the exaggerated accounts of the movements due to earthquakes which can be proved to have been less than a millimetre in amplitude, or his power of detecting the vibration in his house due to a passing traction engine. It is to this sensitiveness that human flight is in large measure due. So long as man control dominates, a concentration of the mass to allow this sensitiveness to operate is required, while the conditions of aeroplane building inevitably distribute the masses a good deal. On my earliest flights I noticed with surprise the distinctness of the double blow produced by a gust first on the front plane and then on the back plane, and from that concluded that a forward feeler would anticipate the truth. This was three years ago. To make this anticipation quantitative it occurred to me that the best forecast of

the probable effect of the gust would be conveyed by a measure of its acceleration. (Note, *not* the acceleration of the aeroplane in relation to the air which it is in, but of the gust.) Any air-accelerometer would do, and as priority of thought is interesting, at least to the inventor, I mentioned the whole matter in detail to Major Fulton, R.A., about twenty months ago. A simple form consists of a light-plate of good aspect ratio, near which hangs a mass (duly sheltered from the wind). The amount of separation occurring between the vane and the bob measures the air acceleration. One feeler is placed forward of each wing. A sort of calliper which measures this separation is made to control a pneumatic motor which alters the curvature of the appropriate wing negatively for a positive acceleration and *vice versa*. If both feelers get a head-on gust both act. It will be observed that as there is pre-warning of the movement of the centre of pressure this can also be used to inflect the tail so as to counteract the upsetting moment due to this movement of the centre of pressure.

A vertical up-gust has the effect of separating the vane and bob as if it was an acceleration, and so long as the vertical gust lasts, the aeroplane needs less lift and the flattening out of the wings is therefore appropriate.

A peculiar feature of the device is that it utilises the one, and I believe only air-difference which exists between a side-gust and a side-slip, viz.: that the gust strikes first one wing and then the other, whereas a side-slip strikes both simultaneously. Thus, on a side-slip occurring, both feelers are equally effected so long as there is side acceleration and no out-of-balance warping is introduced to aggravate the side-slip. Side-slip is cured by the action of the top fin which should provide against it.

The device by anticipating the strength of the gust eliminates the objection to a top fin, which is that it forms a target for a gust.

Throughout all this it is well to remember that a gust is not a gust as far as the aeroplane is concerned as soon as the aeroplane as a whole has taken up the speed and direction which the gust seeks to impose. Accordingly, what appears to be a gust to a fixed observer on a tower ceases to be so to the aeroplane immersed in it. This is the foundation of the use of the air-accelerometer.

Limitation of Elevator Movement.—Mr. A. Sée has strongly advocated protecting the flyer from his own rashness in using his elevator too fiercely for descent. Imbued with the fact that a much depressed elevator gives an inverted longitudinal Vee, he suggests either a stop, presumably such that the inverted Vee is not reached; or a spring giving by its stiffness warning to the flyer that he has reached this point; or a *front* elevator convex downwards; or the automatic operation of the elevator like the Doutre.

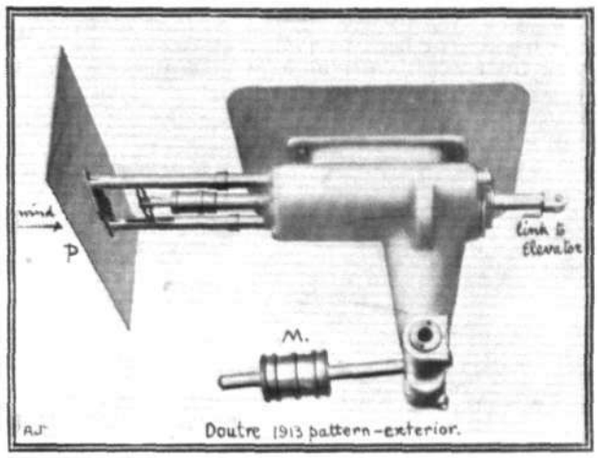
The difficulty of accepting these views outright is shown by the fact that the flyer must be allowed to determine his course, that is to say, in the case of an eddy when the aeroplane may be in the up-current side, and the flyer has, as he may have, good reason not to rise, such as in the presence of an enemy (to avoid appearing over the horizon), or because another aircraft is over him, or because he in fact must at that moment alight, he needs unhampered control of the utmost elevator movement. This is a case for tentative trials as to how far such restriction can be tolerated.

In conclusion, my apologies are due to the countless inventors whose devices I have not mentioned. I only hope they may be here with diagrams and models to fill, in some measure, the lacunæ which I am all too conscious of having left.

APPENDIX.

Doutre stabiliser, 1912 model, weighs 44 lbs. The air-speed causes a pressure on a plate, P, which then compresses a spring, R^1, till the plate shaft rests on an abutment for normal travelling speed. If the speed falls off, the spring tends to send back the plate and this opens one valve of the pneumatic motor in the direction for lowering the elevator.

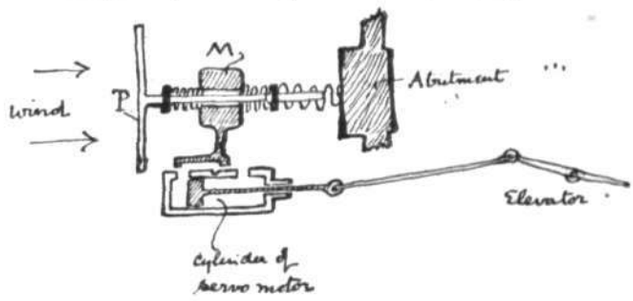
In addition a floating mass, M, slides over the shaft along the line of flight, being kept centred by a spring on each side. These



springs are stiff enough not to be appreciably affected by the fractional weight of M if the aeroplane travels down a slope, but they allow M to travel if there is a more appreciable acceleration of the aeroplane.

It is clear that the valve of the pneumatic motor is controlled by the resultant movement of the plate and mass. Example, if the air-speed falls off the plate takes the position shown, this pushes the mass forward as shown and opens the valve. Had there been a

Diagram of Doutre's speed-maintainer 1912 pattern.



strong acceleration in the direction opposed to the wind the mass, M, would not have come forward, and therefore the elevator would not have been depressed as shown.

In the 1913 pattern the mass is arranged to act vertically instead of horizontally, being connected to the same mechanism by means of a bell-crank.

It is unfortunate that when the aeroplane slopes down a glide, say of 1 in 6, the mass *tends* to move as if the aeroplane were suffering from a retardation, with a force equal to one-sixth of its weight. To this extent there is a tendency to accentuate a dive until the air-speed on the plate, P, is high enough to correct this tendency, aided by the lag of the mass due to any acceleration downwards in excess of one-sixth of gravity.

⊛ ⊛

WORK OF THE FRENCH ARMY AIRSHIPS.

THE following table sets out very briefly the work accomplished during last year by dirigibles belonging to the French army when engaged on military service. It should be noted that the Fleurus, the dirigible built by the French Army, only made three ascents before the end of the year :—

Name.	Size cub. metres.	h.p.	Passengers carried.	Aggregate distance. kilom.	Aggregate time. h. m.
Dupuy-de-Lôme ...	9,700	244	321	4,424	110 0
Capitaine-Ferber	6,000	180	610	5,900	152 0
Fleurus	6,500	150	24	159	3 41
Adjudant-Réau ...	9,000	250	470	3,845	105 39
Temps	2,500	60	66	700	23 26
Adjudant Vincenot	10,000	240	326	2,235	55 0
Total ...			1,814	17,263	449 46

⊛ ⊛

Movements of German Airships.

THE Zeppelin liner "Hansa," now at Potsdam, is shortly to be sent to Friedrichshafen for repairs and overhauled, and her place at Potsdam will be taken by the "Victoria Louise." As soon as the Navy's new Zeppelin L2 is ready, she will be stationed at Johannisthal and the L1 will then be moved on to Hamburg.

Another Aerodrome for Germany.

THE municipal authorities of Sarrebruck in Alsace have decided to set apart a large piece of ground as a landing place for aircraft and have voted a sum of £600 towards the cost of laying it out as an aerodrome.

Flying Over the Jura.

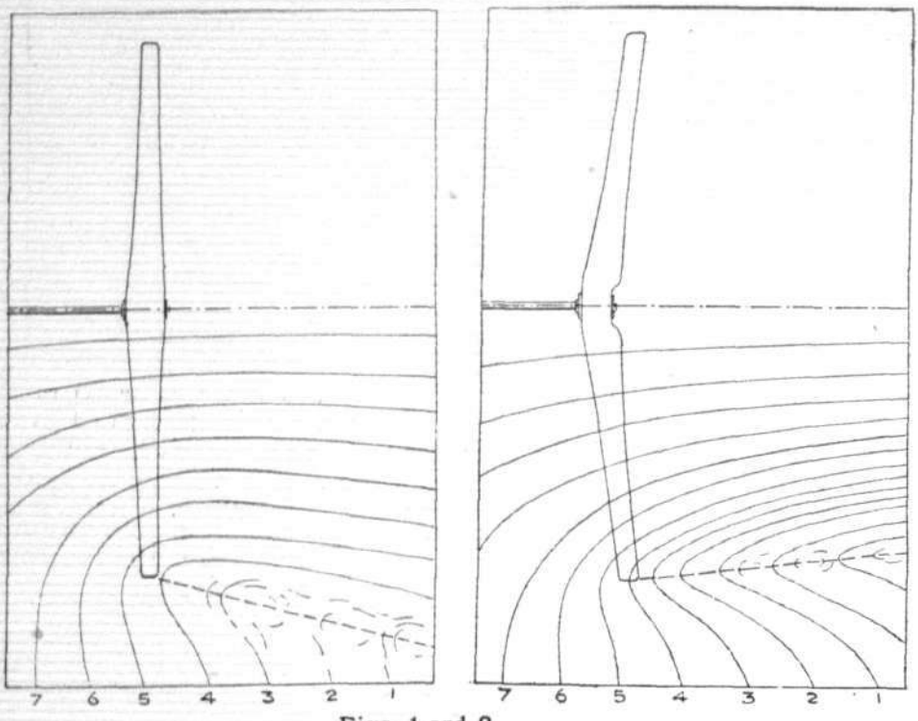
ON the 6th inst. Favre succeeded in flying over the Jura mountain on his Hanriot monoplane. Starting from Bale he went by Weissenstein, attaining a height of 2,800 metres; then flying over Soleure and the lake of Bienne he landed at Landeron after 50 minutes in the air. Subsequently he flew over to Berne in 12 minutes.

THE TWINING PROPELLER.

By E. W. TWINING.

THE principal features embodied in the design of this patented propeller are, narrow blades which taper from boss to tip; blades set backward at an angle of less than 90° to the shaft on the working or back-face side; stream line section with dipping front edge; and uniform pitch throughout. With regard to this latter, however, it should be stated that this is only correct in regard to the chord of the blade camber at all points along the length of the blades.

The propeller was originally designed some two years ago and has since been used in a modified form with considerable success on models made by the Twining Aeroplane Company. The design is based on several theories and objects. Firstly, narrow blades have been found to be as efficient as wide ones with the advantage that skin friction is reduced as the area. Secondly, tapering blades are introduced with the object of making the pressures and centrifugal stresses at all points along the blades approximate more nearly to the circumferential velocities, although it is, of course, recognised that actual agreement is not possible. Thirdly, the set-back blades give a more concentrated slip stream, and, what is of more importance, allow a larger volume of air to be drawn in and driven backwards.

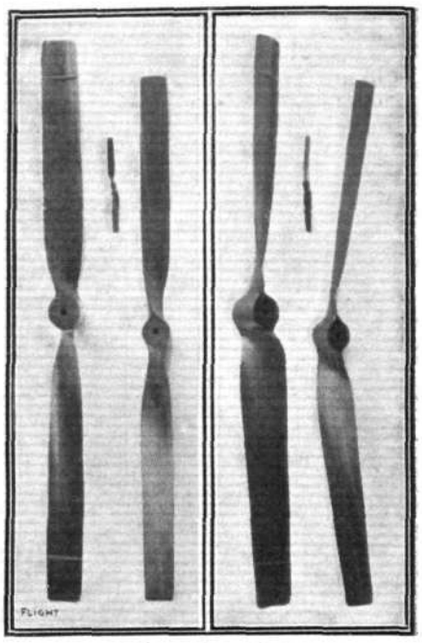


Figs. 1 and 2.

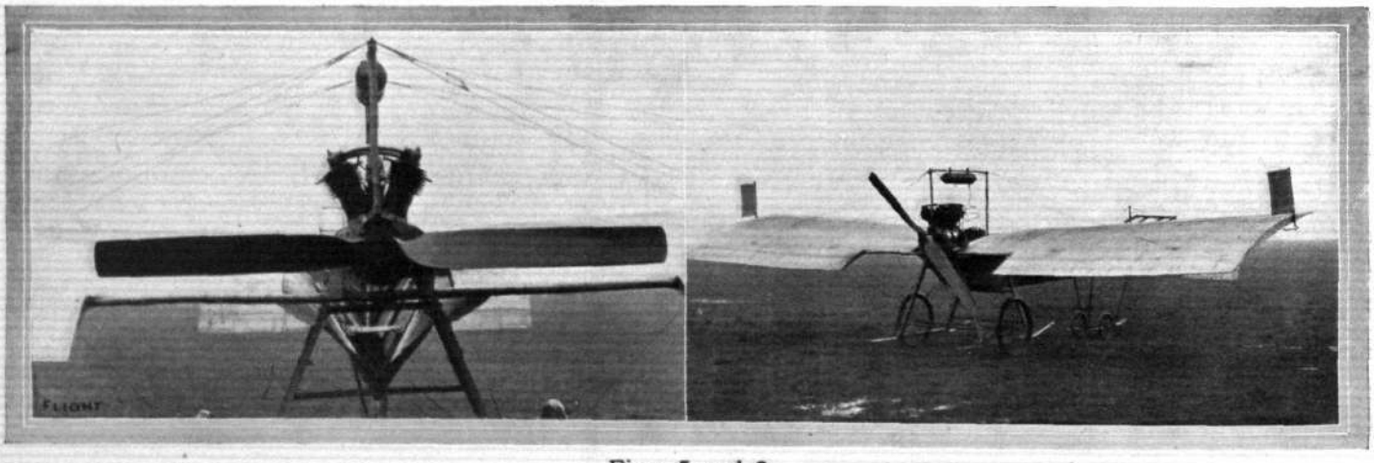
The theory held when the experiments with this type of propeller were being made some four years ago was that air was thrown out centrifugally by the blades of a revolving screw; this idea being pretty generally accepted at one time. With the object of stopping this imaginary loss propellers were made first with blades which curved back at tips and then with the whole blade bent back.

To discover what action really took place some tests were made with smoke streams, using both straight and deflected blade screws, the smoke being produced with the quickly extinguished wicks of candles.

The results are shown in Figs. 1 and 2. Fig. 1 shows a straight screw and Fig. 2 the deflected blades. The curved lines in each case show the path taken by the smoke, whilst the dotted lines show the angles to the propeller-shaft made by the oppositely passing air currents. It was noted that when the slip stream was compressed as shown in Fig. 2, the eddy currents on the dotted lines were much less marked than with the straight-bladed screw. Both propellers under test had the same pitch diameter and blade area.



Figs. 3 and 4.



Figs. 5 and 6.

The photographs, Figs. 3 and 4, show two large built up propellers, one of 6 ft. 8 ins. diameter, 4 ft. 6 ins. pitch, the

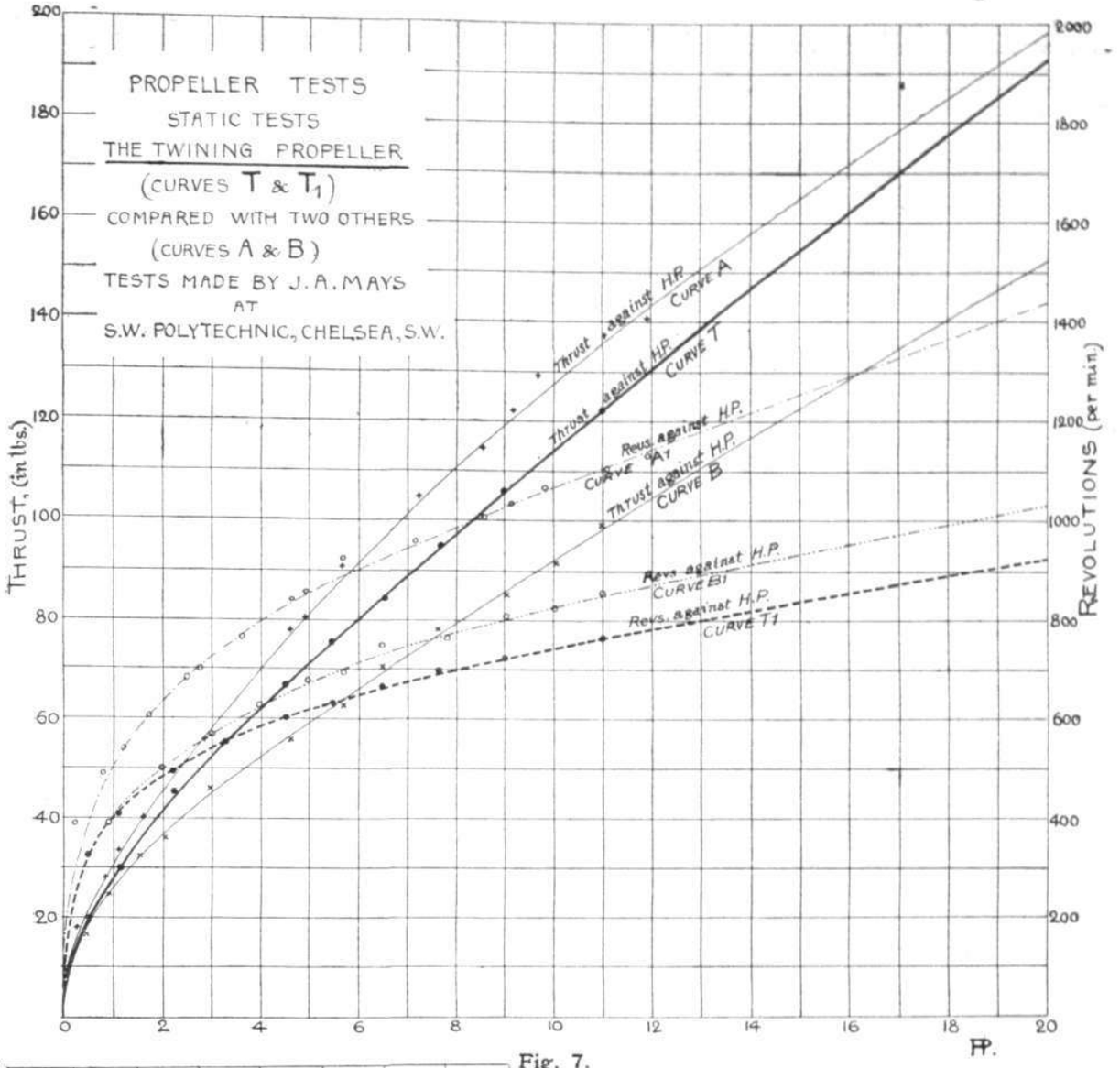


Fig. 7.

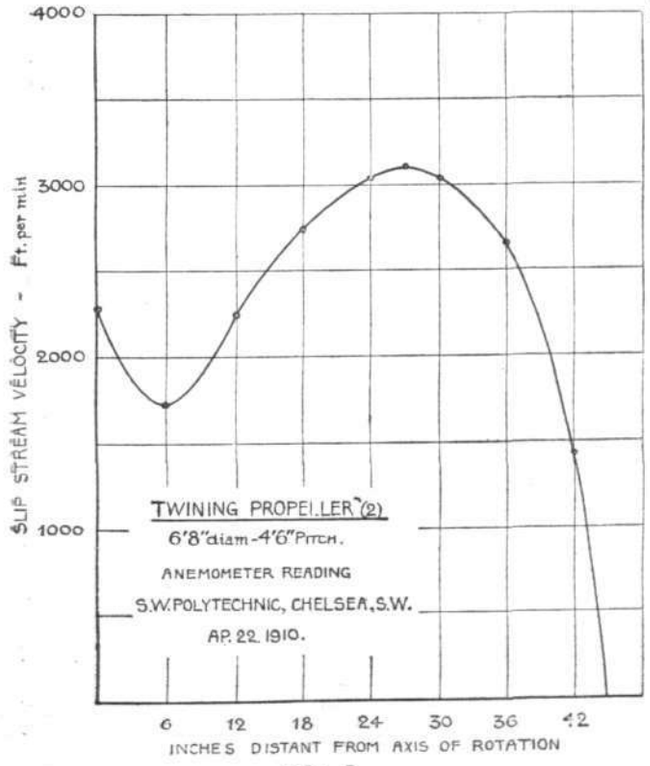


Fig. 8.

other 6 ft. 3 ins. diameter with the same pitch, a model screw is also shown between the large ones.

With regard to the efficiency of this type of propeller, thrust-revolutions against horse-power curves are shown in Fig. 7. These curves have been copied from curves plotted by Mr. Mays, on whose apparatus at the South-Western Polytechnic a 6 ft. 8 ins. propeller was tested. The heavy lines show the Twining thrust and revolution curves, whilst on the same diagram the corresponding curves of two other propellers of well-known make are shown, one of same diameter as the Twining, but with a pitch of 2 ft. 8 ins. and the other 6 ft. 4 ins. diameter and 5 ft. pitch.

From this it will be seen that although the revolutions of the Twining are quite low, considerably lower than either of the other two, the thrust is not much below that of the short pitch screw.

One of these propellers was, some little time ago, supplied to Mr. H. S. Dixon and fitted to his 2-1-P-0 type (tailless) monoplane, with which he was then experimenting on the Aviation Ground at Acton.

Figs. 5 and 6 are photographs of the machine and power-plant, showing the propeller fitted. The dia-

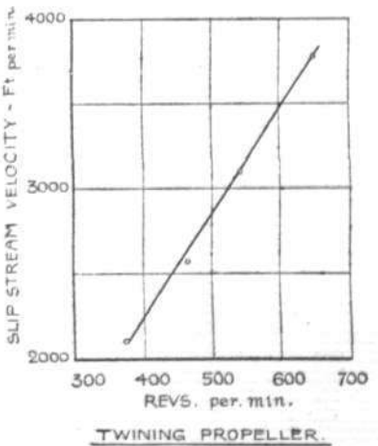


Fig. 9.

meter is 6 ft. 4 ins. and pitch 4 ft., revolutions 1,000. The engine is a 4-cyl. air-cooled, of 25-h.p. It should, however, be stated in favour of the propeller that although the machine repeatedly got off in runs of less than a hundred yards, the engine was never required to be run "all out."

Two other curves of interest are those given in Figs. 8 and 9, reproduced on the previous page, the first showing the variation of slip stream velocity at different points in the disc area, and the second showing the variation of velocity with revolutions.

AERONAUTICAL ENGINES.

(*Concluded from page 266.*)

The whole matter is obscured by reason of the fact that many of the most successful flights have been made with air-cooled engines of the rotary type; indeed, it cannot be denied that but for the advent of such engines aviation would never have progressed as far as it has, because water-cooled engines at that time derived much of their lightness by a reduction of a factor of safety employed, and an increase in bearing pressures, with the result that the liability was impaired. Any engine, therefore, that could give equal results with a reduction in weight was welcomed with avidity. The author is of opinion, however, that the large amount of power absorbed in rotating the cylinders, the increased air resistance offered, the un-uniform distribution of heat in the cylinder walls, and the variation in cooling effects at varying speeds renders the adoption of this method of reducing weight a very doubtful expedient for obtaining a high effective horse-power per unit of weight now that reliability has come to assume such an important aspect.

With regard to the method indicated in (h), it must not be forgotten that the increase of power obtained by raising the speed of revolution is not an entire gain, for the weight of the gearing and its supports, possibly some reduction in the mean effective pressure, and certainly the loss of power through transmission by gearing will cause the ratio of weight to power to be somewhat greater than is indicated by the increase in the speed. Also, higher speeds of revolution naturally tend to increase the wear of the moving parts, and render the possibility of engine failure greater, since few engines are able to run for prolonged periods under such conditions. Hence such a system is not recommended for general adoption.

Turning to the second aspect of reliability, namely, the absence of trouble from defective lubrication, cooling, carburation, and ignition, it will be found that the problem of cylinder lubrication is closely connected with that of cylinder cooling, and the water-cooled engine is superior in this respect for heavy and sustained loads to the air-cooled engine on account of the lower and more uniform temperatures employed. Furthermore, the vertical engine is superior to any other form of engine so far as cylinder lubrication is concerned, because the supply of lubricant is under better control, and is more uniformly distributed, as the conditions are practically the same in all cylinders. With cylinders placed beneath the crank-shaft, provision must always be made to prevent oil draining into them, and this may or may not be entirely effective, according to the quantity of oil in the crank-case. In any event the lower cylinders will receive a larger amount of oil than the upper cylinders, and this may be sufficient to cause flooding. In a modified degree these remarks will apply to Vee and semi-radial engines. To overcome the difficulty of insuring the uniform distribution of oil, the rotary engine may be adopted, but in addition to its defects in respect of cooling (it is hardly possible to use water-cooling for this type of motor) and air resistance, there arises another in that the oil consumption of such engines is excessive. This is only to be expected, since with ordinary engines there is quite enough difficulty in keeping the oil down from the cylinders, while in this case the oil is fed by centrifugal force, and carried by the fresh incoming mixture through the inlet valve into the cylinders. To reduce these troubles, which must always exist to a greater or lesser extent, forced lubrication to the gudgeon-pin and the cylinder seems to be the only remedy, as by this means the quantity of oil may be regulated by experiment to a nicety.

With regard to the bearings, it is essential that there always should be a film of oil between the surfaces. The maintenance of this oil film depends upon the use of suitable bearing pressures, the elimination of distortion at the bearings, and the continuance of sufficient viscosity in the oil. Granted that the bearing pressures are not excessive, it will be clear that the shorter the distance between the bearings the more rigid will be the shaft, and, therefore, the less the liability to distortion. Hence, a bearing should be provided between each crank, and it is preferable not to attach two connecting-rods to one crank-pin, as is necessary with Vee engines, on account of the increase in the distance between the bearings which this leads to. The viscosity of any oil depends upon its temperature, and since the oil will reach very high temperatures when engines are run for prolonged periods at heavy loads, it is desirable to fit some cooling arrangement. This may take the form already mentioned as provided in the Dorman and the Wolseley engines, but preferably a separate cooler should be included in the design. It is noteworthy in this connection that the Napier, the Sunbeam and the Green engines, which have successfully undergone severe trials of long duration, have fully forced lubrication systems and bearings between each crank. To ensure that the oil delivered to the bearings shall be free from any foreign substance, it is necessary that a filter should be inserted in the system. By the adoption of these means it is possible to obtain some immunity from trouble from over lubrication, as a supply of pure cool oil in sufficient quantities can be fed to every part continuously. It may be added that practically all these engines have forced lubrication to the main bearings, but it would appear that the advantage to be gained by the extension of the system throughout the engine more than compensates for the increased cost of manufacture entailed.

Carburation difficulties may arise in any petrol motor, since the mode of carburetting the air depends for its efficiency upon the particular design of carburettor employed, but on account of the comparatively small variations in power output required during flight, there should be little difficulty in satisfactory working.

There is, however, one aspect of the question which should receive attention, namely, that of the effect of altitude.

Assuming that the barometric pressure at the sea level is 30 in. of mercury and the temperature 15° C., at a height of about 5,000 ft. the barometric pressure will have fallen to 25 in. of mercury and the temperature to 8° C., assuming average atmospheric conditions. Since the weight of one cubic foot of air is 0·0807 lb. at 0° C. at the sea level, the weight of one cubic foot will be $0{\cdot}0807 \times 273/288 = 0{\cdot}0765$ lb. at 15° C. at the sea level and $0{\cdot}0807 \times 273 \times 25/281 \times 30 = 0{\cdot}0653$ lb. at 8° C. at a height of 5,000 ft., that is, the weight of air will be in the ratio of 1 to 0·854. Further, the difference of pressure causing petrol to issue at the jet so far as velocity and static head are concerned will remain practically the same at any elevation, while the engine is running at a constant speed except for an increased viscosity of the fuel. Sorel gives a chart on p. 166 of his book on "Carburetting and Combustion in Alcohol Engines" from which it will be seen that the quantity of petrol discharged through a capillary tube under constant pressure at 8° C. is 0·965 of that at 15° C. Hence the mixture will tend to become richer in the proportion of 0·854 to 0·965 or 1 to 1·13.

Since most engine builders employ high tension magnetos for igniting the charge, and these have reached a high standard of perfection, it is not anticipated that trouble is likely to arise from this cause provided that extraordinary conditions do not prevail, that is, as long as the speeds at which they are driven are kept within reasonable limits. In general, these are satisfactory, but with the tendency to increase the number of cylinders or to run at high revolutions and gear down the propeller, it is preferable to fit two magnetos (as is sometimes done) rather than to risk failure in such an important part. The two magnetos will obviously require careful synchronising and adjustment, and will increase the weight slightly, but the advantage derived more than compensates for so doing.

Economy in Fuel and Oil.—These will be the greater with engines having high mechanical and thermal efficiencies and embodying very careful design, but although the air-cooled engine works at a higher temperature, the compression pressure that can be employed is limited, and hence the thermal efficiency is not greater than that obtainable with water-cooled engines, and on account of the greater frictional losses in the pistons, the mechanical efficiency is lower. Therefore, the fuel consumptions per b.h.p are, in practice, slightly less with the water-cooled than with the air-cooled engine. This is indicated in Table III, for, with the exception of the result recorded for the 60-h.p. Anzani, and which, it may be added, is open to considerable doubt, the average results for air-cooled motors are worse than for those using water-cooling. It should be noted, however, that practically all the results, excepting that for the Albatross, are excellent, and hardly likely to be improved upon.

The same tendency is also exhibited in the table with regard to oil, and as this has been referred to previously, nothing further need be added.

The *Air Resistance* offered by air-cooled engines has been considered when dealing with the methods by which the weight may

be reduced, and it would appear to be one of the necessary accompaniments of this type, since, in order to assure that an adequate quantity of air will pass over the cylinder, they must be arranged in fan or radial fashion. For low machine speeds, stationary cylinders are almost impossible, and render the use of the rotary engine essential, but with higher speeds now employed, a radial or semi-radial motor can be successfully fitted. Air-cooled Vee engines, or any other type of engine in which the cylinders are arranged in line, should not be used unless a system of fan-cooling is adopted (as in the Renault), since the leading cylinders obscure those that follow, and do not allow of effective cooling.

In regard to the water-cooled engines, that type will offer least resistance which has the least exposed area in the direction of motion, and the smoothest exterior. This is in favour of the vertical engine, since it can be more efficiently enclosed with a casing having a stream line formation.

Vibration.—Little fault can be found with most engines in regard to balance on account of the care taken during manufacture to ensure the uniform distribution of weight, but the absence of fly-wheels on many stationary motors and hence the reliance which must be placed upon the propeller for uniformity of torque calls for a few remarks. In cars the variation in the torque transmitted from the engine is largely absorbed in the elastic deformation of the transmission gear and the stressing of the tyres, and excess or deficiency above or below the mean energy required to propel the car are thereby compensated for. But when the conditions are such as those under which the aeronautical engine is most frequently employed, namely, when the propeller is directly coupled to the engine, the variation in torque will tend to accelerate or decelerate the rotating parts, thus conducing to the inefficient working of the propeller by augmenting the "slip."

It is not at all improbable that this is one of the reasons why the rotary engine has been so successful, for it is well known that they do not develop within 10 per cent. of their rated horse-power, yet stationary engines of equal rated power, have, in many instances, failed to produce superior results.

Accessibility.—Opinions differ as to the extent to which provision should be made in this respect, but there would appear to be no reason why adequate access should not be given to valves and to the interior of the crank-case. With many of the engines now used for aeronautical purposes it is necessary practically to dismantle the valve gear in order to examine the valves, and in the case of rotary engines, to remove the cylinders. It is true that a cylinder of, say, a Gnome engine, can be dismounted in 20 mins., but seven cylinders will absorb 2 hrs. and 20 mins. at least, and on account of the excessive oil consumptions of this class of engine frequent attention to the inlet valve, upon which so much depends, is very necessary. As regards other parts of the motor, the principal point to bear in mind is the abolition of a large number of small screws or bolts and nuts for the attachment of parts, while it should be possible to effect the removal of, say, the bottom half of the crank-case without disturbing any portion of the gear other than that which is actually carried on that half, and this should be of limited extent.

Silence and Cleanliness.—All working parts should be totally enclosed and be automatically or mechanically lubricated, otherwise trouble may arise from this cause. Considerable success has attended the efforts of designers of automobile engines to silence the valve actuating mechanism by enclosing these parts and improving the details, but with many aeronautical engines there is ample room for improvement, as the form of gear resembles a type that has been long discarded in road vehicles on account of the chatter and vibration which it is impossible to prevent.

Further, the engine exhaust should enter a common pipe which may then be led to some convenient position, where it will not cause discomfort to the pilot and spread unburnt oil in all directions. This is, of course, quite impossible on rotary engines, and becomes a complicated matter on engines fitted with an auxiliary exhaust. Preferably some form of silencer should be employed.

In conclusion, the author has adopted a somewhat critical attitude with the object of bringing out the views of those who, from experience in the construction and the working of these engines, are well qualified to speak. It is to be hoped that the subsequent discussion will fulfil a useful purpose in forwarding the development of the aeronautical engine in this country, so that it may soon arrive at a position in the world as high as that now held by the British automobile.

The author acknowledges with pleasure the assistance he has received from Mr. MacIvor in calculating the values of $\eta\rho$ and the thermal efficiences of engines given in the tables; also of the manufacturers who have been good enough to favour him with photographs and particulars of their productions.

AERONAUTICAL SOCIETY OF GREAT BRITAIN.

Official Notices.

Annual General Meeting.—The annual general meeting will be held on Wednesday, March 26th, at 8.0 p.m., followed at 8.30 p.m. by a lecture, to be followed by a discussion, on "Hydro-Aeroplanes" by Commander C. R. Samson, R.N.

Associate Fellowship Election.—Application forms for the next election of Associate Fellows, which will take place early in April, can now be obtained from the Secretary, and it should be noted that it is not necessary that the applicants should be Members of the Society.

Easter Vacation.—The offices of the Society will be closed from Friday, March 21st, to Tuesday, March 24th.

BERTRAM G. COOPER, Secretary.

KITE AND MODEL AEROPLANE ASSOCIATION.

Official Notices.

British Model Records.

Hand-launched	Distance	A. E. Woollard	477 yards.
	Duration	A. F. Houlberg	89 secs.
Off ground	Distance	G. Rowlands	232 yards.
	Duration	A. F. Houlberg	51 secs.
Hydro, off water	Duration	G. P. Bragg-Smith	25 secs.
Single-tractor screw, hand-launched	Distance	F. G. Hindsley	173 yards.
	Duration	F. G. Hindsley	36 secs.
Do., off ground	Duration	H. R. Weston	21 secs.

Gift of Prizes.—Mr. Claude Grahame-White has kindly given a trophy for competition. It will be known as The London Aerodrome Model Aeroplane Trophy, and will be competed for at the aerodrome.

Trials.—The official trials take place at Sudbury to-day (Saturday), at 3 o'clock, on the Paddington and District Aero Club ground.

Annual General Meeting.—The annual general meeting will be held on Thursday, March 27th, at 7.30. Notices will be posted to every member. It is hoped that all members will endeavour to attend. After the usual business the meeting will discuss suggestions for competitions for the year. Any such suggestions should be written and handed to the Secretary prior to the discussion.

27, Victory Road, Wimbledon, S.W. W. H. AKEHURST, Hon. Sec.

MODEL CLUB DIARY AND REPORTS.

CLUB reports of chief work done will be published monthly for the future. Secretaries' reports, to be included, must reach the Editor on the last Monday in each month.

Aero-Models Assoc. (N. Branch) (15, HIGHGATE AVENUE, N.).

WILL all members attend at the Finchley ground, March 15th, at 2.30 p.m., when an inaugural contest will be held?

Ecclesall and District (50, CRESCENT ROAD, SHEFFIELD).

MARCH 22ND.—An "aerial Derby" will be held at Bent's Green, Ecclesall. Rules: Prizes will be awarded to the three competitors who cover the course in the least number of flights. Each time a model is launched to count as a flight. Each competitor is to be accompanied by an "observer," who will record each flight, and submit it to the judge at the close of the contest.

Leytonstone and District Aero Club (64, LEYSPRING ROAD).

SUNDAYS, model flying near Bushwood Avenues at 9.30 a.m. March 18th, general meeting at 64, Leyspring Road, 8 p.m.

Manchester Model Ae.C. (14, WARWICK RD. N., OLD TRAFFORD).

MARCH 15TH.—Meeting, 3 o'clock, at Trafford Park Aerodrome. Easter arrangements: Meetings for prizes on the Friday, Saturday and Monday, from 10 a.m. to 5 p.m. each day, and if wet weather prevails in the mornings and clears up later on the meetings will be held in the afternoons.

Sheffield Model Aero Club (35, PENRHYN ROAD, SHEFFIELD).

MARCH competition is for self-rising models. First prize: 2s. 6d. cash, or bronze aviation medal for longest duration. Second prize: Total entrance fees received for best added flights. Special prize: Mr. J. P. Worrall is presenting one pair 9-in. 20-in.-pitch carved poplar propellers for the best duration flight during the month (hand-launched), to the member who has not already won a prize. Club room, 32, Carver Street, is open all the afternoon Sundays.

S. Eastern Model Ae.C. (1, RAILWAY APPROACH, BROCKLEY).

Blackheath and East Dulwich branches: March 15th, Kidbrooke, 2.30 p.m. to 5.30 p.m.; 16th, Blackheath, 7.30 a.m. to 10 a.m.; Lee Aerodrome, 10.15 a.m. to 12.30 p.m.

Croydon and Beckenham branches: March 15th, Duppas Hill, 2.30 p.m. to 5.30 p.m.; 16th, Mitcham Common, 2.30 p.m. to 5.30 p.m.

Impromptu competitions will be held at Kidbrooke and Blackheath.

Hydro-Aeroplanes for the Congo.

THE enquiries made by the committee appointed by the Belgian Colonial Minister to consider the possibility of utilizing aeroplanes in the Belgian colonies has resulted in the drawing up of a scheme for a competition for hydro-aeroplanes suitable for use in the Congo territory. Entries have to be made by April 15th.

A Blériot in Indo-China.

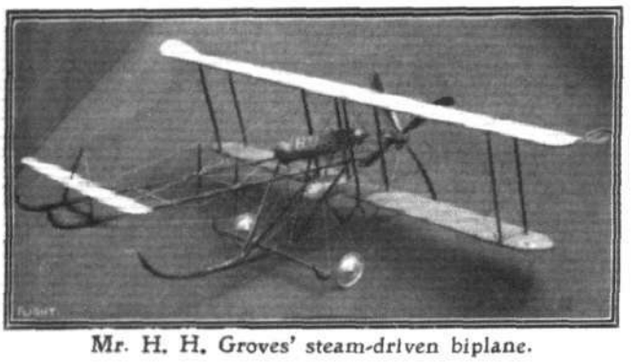
ONE of the best flights in Asia up to the present was made by Georges Verminck on the 1st inst. On his Blériot with 50-h.p. Gnome and Chauviere Integral propeller, he started from Saigon, the capital of Indo-China and flew the 400 kiloms. to Pnom-Penh, the chief town of Cambodge in four hours and a half. He was received at his destination with great enthusiasm and was decorated by the King of Cambodge. On the 6th inst. Marc Pourpe made the trip back to Saigon.

Models

Edited by V. E. JOHNSON, M.A.

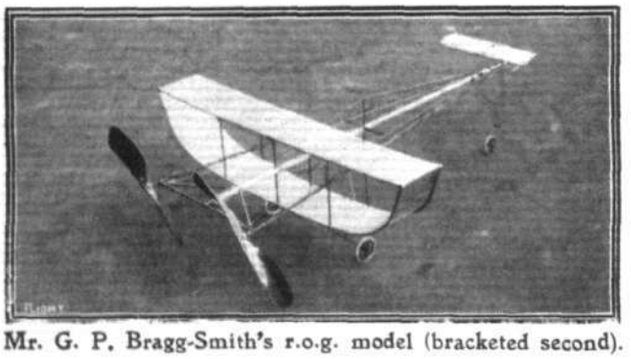
The Flying Tests at Hendon.

THE models recently exhibited at Olympia were on Saturday, March 1st, submitted to their flying tests at the Hendon Aerodrome in the morning, and the Welsh Harp, Hendon, in the afternoon. There were, of course, some notable exceptions, but as average results they were undoubtedly very disappointing, and considerably below those obtained last summer time. The two following causes undoubtedly had a great deal to do with it. In the first place, the day was a decidedly unfavourable one, and in the second place there is the time of the year to be taken into account. It is obvious that models do not fly so well at this time of the year as in the summer. This applies more especially to self-rising models, whether off land or water. Flying as these do with less reserve of



Mr. H. H. Groves' steam-driven biplane.

power or with more proportionate head resistance (whichever the case may be) they were the most affected. Still when every allowance of this kind is made, it must be candidly confessed that some further explanation must be forthcoming to account for the fact that in the r.o.g. tests, which contained a list of some 59 names, only some 17 or 18 actually flew their models, and of these only 3 succeeded in accomplishing the qualifying tests of 30 secs.; as a matter of fact, no other competitor was successful in making a duration of more than 17 secs. Some of the competitors had, we know, smashed their machines in the interim; several withdrew at the last minute; and it was also said that one or two of them were under a misapprehension as to the fact that they could launch their machines *either* with or against the wind; also the fact that they were not permitted to tune up their models just prior to flying was said by some to have adversely affected them. So far as this latter matter had any effect it was the same for all, and this tuning

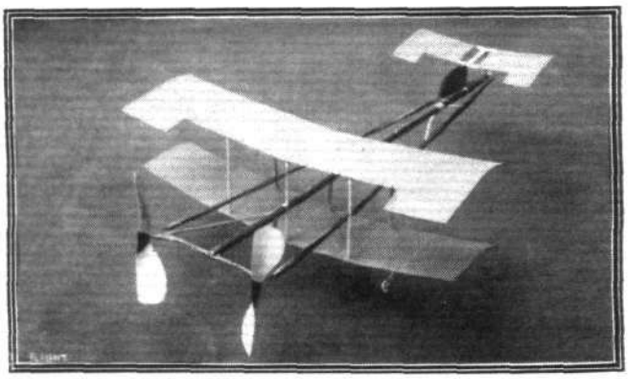


Mr. G. P. Bragg-Smith's r.o.g. model (bracketed second).

up of models just prior to flying them in competition is a matter which most certainly requires some ruling on the part of the K. and M.A.A., in order to prevent it becoming nothing more nor less than an unmitigated nuisance to observers and judges; one trial flight should be permitted, no doubt—perhaps two, but certainly no more. The best duration in the case of the self-rising models was made by Mr. L. H. Slatter, viz., 44·8 secs.—a very fine performance under the circumstances; the next best was Mr. J. McBirnie's 32·8 secs., and the next Mr. G. P. Bragg-Smith's 31·4 secs.—none of the foregoing succeeded in making more than one flight of over 30 secs. out of the three trials allowed. Several well-known aeromodellists failed to conquer the elements with their machines. Of the first twelve on the list (so far as design and construction went), only six actually competed at Hendon. There is, undoubtedly, plenty of scope still left in the designing of r.o.g. rubber-driven models; we refer more especially to the best flying type, viz., where twin-propellers are used. The enclosing of the rubber motor skeins in stream-line bodies would undoubtedly add much to their appearance and finish, and in a great measure take away from them that toy-like appearance which anything driven by a *visible* spring (torsional or otherwise) always seems to possess. The following incident which occurred to the writer some two years ago, but which he has never so far recorded in print, is perfectly true. He was out with a young French friend flying a model on Mitcham Common; the model made a high and circular flight, and landed not very far away close by a path. Two women were crossing the common by this path, and came up to the model at almost precisely the same instant as a friend of the writer's. "How does them things go?" one woman asked the other. "Why! by liquorice power, can't y' see?" immediately replied the other, pointing to the rubber. To be perfectly candid, I have never liked the *look* of rubber since that day.

In the last Wakefield competition the best duration was made, if we remember rightly, by Mr. Bates, who flew a machine with twin propellers, in which the two rubber motors were contained in thin veneer tubes, so no objection can be urged against it on the score of efficiency. Provided that something really light and efficient could be devised in the nature of a very frictionless chain drive, the two rubber skeins could, of course, be contained in one stream-line central body *monocoque* design which would have the additional advantage of concentrating the weight more about the centre, *i.e.*, lessening the moment of inertia laterally about the fore and aft axis, which would be a decided advantage from the point of view of lateral stability.

In Class 26—the hand launched competition—the display of flying given was far better, and of course so far as the mere sport of model aeroplaning goes, there is far more satisfaction to be obtained, so far as distance or duration alone are concerned, out of a hand-launched model than out of perhaps any type. In competent hands it never fails to give a good spectacular display, even under adverse conditions, and the display given at Hendon was no exception. The best flight was one of 79 secs. made by Mr. A. F. Houlberg, who holds the official records for hand-launched as well as r.o.g. models, the former with a flight of 89 secs. made last summer at Greenford. The next best was (we believe) one of 54 secs. made by Mr. J. E. Louch. Personally the writer saw but little of this particular contest, being engaged at the time in consultation with respect to the r.o.g. trials.



Mr. J. McBirnie's r.o.g. (bracketed second).

The most novel and undoubtedly the most interesting from an expert's point of view was that of the power-driven models, in which models driven by petrol, by steam, by carbonic acid gas and by compressed air were ranged one against the other. The struggle, curiously enough, lay between compressed air and steam, and became one of all-absorbing interest owing to the international character which it assumed, being a contest between a representative of a a French club, L'Essor Français (18, Rue Oudry, Paris), and Mr. H. H. Groves (18, Westerdale Road, East Greenwich, S.E.). The

former pinned his faith to a very lightly-built model—a biplane (illustrated in last week's issue), fitted with a rotary engine, two to one gear, and driven by compressed air—the gas being contained in two long cylindrical-shaped aluminium tubes forming the backbone or *fuselage* of the machine. These cylinders were not charged with a pump, but from a strong, steel cylinder of gas under great pressure by means of a flexible metallic tubing.

Mr. Groves' model was driven by steam, flash boiler type—in which benzoline is employed as the heating agent. Between the two types there is this important difference: the French model, like a rubber-driven one, only gave out the energy previously put into it; the English one developed its own energy and gave it out as required. The French model put up a flight of 35 secs.—which certainly came as a surprise to many there, and was warmly applauded—the English model of 40 secs., a difference of 5 secs. only. There was, however, all the difference in the world between the two flights. The French model remained off the ground for the duration above stated, being launched with the wind.

Mr. Groves' model—launched against the wind—turned into it in a left-handed spiral, and although now flying with the wind, continued to climb rapidly until its store of energy was exhausted (it was only partially charged), and planed down to earth without damage from quite a high altitude. In his second attempt with this model, the machine was caught by a gust just as it was rising (always a critical time) and overturned; this had the effect of stopping the propeller and engine, and before the latter could be set going again the boiler burst under the enormous pressure of steam. We should state, however, that the boiler (steel coils) was a very old one, or such would most certainly not have happened, even under such circumstances; as a proof of this we may state that we have had the same thing happen personally two or three times without any burstage.

Previous to this Mr. Groves, who had two machines entered—a new biplane (see illustration), built specially for the competition, the monoplane being merely one held in reserve—had attempted to fly the biplane but without success owing to his discovering, too late to mend it, that a pin in one of the connecting rods of the engine was loose; he was thus left at the close of the contest with both machines *pro tem. hors de combat:* and as Mr. Stanger failed to get his large petrol-driven model to quit *terra firma*, and Mr. Desoutter's model unfortunately came to grief owing to a bad landing after a short flight, it will be seen how very fortunate it was, so far as England was concerned that the upsetting gust in Mr. Groves' case did not come along at his first attempt with his monoplane instead of at his second, as nothing in that case could have prevented the prize from going to France. We should just mention that both Mr. Groves' and the Frenchman's models were of the Canard type, whereas both the others were of the tractor type. This competition again proving (so far as models are concerned) the superiority of the former type, chiefly, of course, for the reasons stated in last week's issue.

So far as most of the aeromodellists and spectators at Hendon were concerned, it was the first time they had actually seen a power-driven model in free flight, and there is no doubt the exhibition was much appreciated. Now that something in the nature of a real commencement has been made, we trust it will not be long before our official British model records include a power-driven model record amongst their number.

The hydro-aeroplane trials were flown off at the Welsh Harp in the afternoon, in a very gusty and tricky wind, and on (for models) decidedly rough water.

The competition sheet contained 18 names, of which 11 actually competed. Of these, only three in this case also succeeded in making the 15 secs. qualifying duration test, although a fourth (Mr. A. F. Houlberg) nearly succeeded in accomplishing it.

The three best flights were made by Mr. W. J. Williams, 21 secs.; Mr. G. P. Bragg-Smith, 20 secs.; and Mr. L. Slatter, 21 secs. The stability and steadiness of flight shown by Mr. Williams' and Mr. Bragg-Smith's models was extremely good; Mr. Slatter's exhibited too great a tendency to circle. Several competitors failed to quit the water altogether, and several more only succeeded in obtaining flights of a few seconds, not really flights at all in the true meaning of the word. Mr. C. Fleming-Williams had no trouble in getting his model off the water, but, rising steeply against the wind, it forthwith either dived head first into the water or was blown back by the wind. It is rather a pity one flight was not attempted with the wind.

The strong wind which was blowing caused the models which actually flew to circle round, and alight on land rather than on the water, one or two flights being spoilt by hitting trees. Better results would very possibly have been obtained had the models been flown from the other side of the lake. Mr. Williams and Mr. Slatter were flying the same type of model, a type of model which was considered by the judges to be a very good *hydro*-aeroplane save that more lateral flotational stability would be a decided advantage.

Scientific Model Building.

VI. Propellers, their Design and Construction.

Blade area.—Reference has already been made to the fact that it is the function of a propeller to produce dynamic thrust, *i.e.*, to drive the machine forward by driving the air backwards. At the same time it is most desirable for efficiency that the air shall be set in motion as little as possible—this representing so much power wasted; to obtain the greatest reaction or thrust, the greatest volume of air should be accelerated to the smallest velocity. In marine engineering in the case of slow-speed propellers, narrow blades are usually employed, but the result of a number of recent experiments is to show that the blade area can be modified to a considerable per cent. without any falling off in efficiency.

In high-speed marine propellers the area of the blades is sometimes as much as 0·6 of the total disc area, but then in the case of marine engineering there is the question of *cavitation* to be taken into account. Cavitation is when the high speed of the propeller causes it to tend to scoop out a pocket in the water. In the case of aerial propellers, where cavitation does not occur (not, at any rate, in the case of models), it would appear that narrow blades are the best. And in the case of power-driven models we have certainly obtained the best result with narrow blades. Theoretically also it would appear that the blades should be narrow in order that the air may not be acted on for too long a time, and so put too much in motion, and the blades be so separated that one blade does not disturb the molecules of air upon which the next following one must act, and so on. In the case of rubber-driven models, the blade area is often somewhat larger, but then there is always in such a case as this, the peculiarities of the rubber motor to be taken into account, also such propellers have a much slower speed of rotation, which also affects the result. Requisite strength and stiffness also set a limit on the final narrowness of the blades, apart from any other considerations. As already stated, the velocity of rotation has an important bearing on the point, but in the case of rubber-driven models a high speed is not desirable, and some very successful models have been built in which the blade area is of very fair size, but a wide blade in the case we are considering, viz., hollow-faced blades, means a large angle, an angle probably excessive for any other form of motor.

The chief point at issue being that it is always more efficient to engage a large amount of air and impart to it a small velocity, than to engage a small amount and impart to it a high velocity.

(*To be continued*).

CORRESPONDENCE.

Correspondents communicating with regard to letters which have appeared in FLIGHT, would much facilitate ready reference by quoting the number of each letter.

The c.g. of the Farman biplane.

[1734] Could any reader inform me as to where the c.g. is, on a Henry Farman biplane? FLIGHT, October 19th, 1912.

Also the size of the floats on the same make of waterplane.

Chester. "FARMAN."

Negative Wing-Tips.

[1735] With reference to Mr. Hume-Rothery's letter (1728), I think mine (1715) was correctly printed. But, indeed, my intentions were quite innocent of dispute with the conclusions to be drawn from Mr. Hume-Rothery's article; which seems to me to be a perfectly correct application of Bryan's method, with the proper alteration in the expression of the terms involved, to the case in hand, because it had been shown in the article that negative tips could be so designed as to nullify the effect of the particular modification of U considered. What I wished to draw more particular attention to, was that the nullification of this particular modification of U would leave other modifications of U outstanding, and their effects would therefore be more prominent, and more easily distinguishable, than they are at present. Perhaps my terming U variable when I ought in strictness to have described it as modifiable, so that it would be a different constant at different places, as, for instance, at different distances to right and left of the plane of symmetry, has led to Mr. Hume-Rothery's letter. It is not easy to keep one's language always free from mistakes of that kind.

MAURICE F. FITZGERALD.

The Thrust of Small Propellers.

[1736] There is a point which I cannot understand, concerning the thrust of a propeller being less in proportion than that of an exactly similar one of double its diameter. Thus, a 7 ft. diameter propeller, with a 30-h.p. engine, has given over 300 lbs. thrust. According to this, a propeller of 7 ins. diameter, with a 2½-h.p.

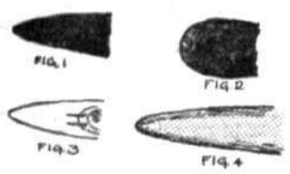
form of energy, should give 25 lbs. thrust, which is absolutely impossible.

G. E. BLUNDELL.

[It would be more to the point to compare D^2 than D. Thus, when D = 7 ft., D^2 = 49 sq. ft., for 30-h.p. this represents an expenditure of 1·63-h.p. per sq. ft. Alternatively when D = 7 ins. D^2 = 0·3 sq. ft., which for 2½-h.p. represents 8·3 h.p. per sq. ft. Clearly the energy wasted in the smaller propeller is immensely greater than in the larger propeller and the thrust proportionately will be much less.—ED.]

Streamline Bodies.

[1737] I have been reading the discussion that is going on in your paper of late on "stream-lining." To tell the truth it is a difficult matter to prove, because the favour of the argument tends in both directions. I shall here try to point out the favours in both. First of all we know that a point is gradually going nearer to nothing than a hemispherical thing, consequently offering less resistance, and again the pointed section divides the fluid more gradually than the hemispherical section, because the hemispherical section displaces the air more abruptly, thus causing more pressure on section, and, *i.e.*, more head resistance.



It is very difficult to make a point, and, therefore, it would be best to round the point off a little as in Fig. 1.

I do not at all agree with Mr. M. L. Robinson, who states that a section, as in Fig. 2, is the most perfect stream-line. Mr. Heller is incorrect when he states that battleships have pointed bows, because the bow goes as in Fig. 3, not to a point. This is a fact which if Mr. Heller wants to investigate into the matter he will find it a correct statement.

Again, he states that a pin is pointed; it may sound funny to some if I say that a pin is not *pointed*. If you magnified a pin to the size of an aeroplane fuselage it would appear thus, as in Fig. 4, so it seems that Mr. Heller is incorrect in most of his arguments.

Folkestone. A. M. O'NEILL.

[1738] With reference to Mr. Ferguson's letter (1684), he appears to have taken for granted that the direction of the wind is always *horizontal to the path of flight*.

This, of course, is not the case, as the direction of the wind is greatly influenced by the contour of the ground over which it is passing. I entirely agree, therefore, with Mr. Robinson's statement (1671) that the figure "B" has less resistance than figure "A," and for the following reason:—

Referring to page 91 in that excellent little book, "Principles of Flight," it is there stated that "The trend of the relative wind in

flight is always changing and, unless a sharp cutting edge properly divides the stream, it would seem likely to give rise to surfaces of discontinuity, which are sources of inefficiency. A rounded or hemispherical head, on the other hand, would be equally effective in any forward direction, and the air stream would make its own division at the point best suited to the condition of the moment."

This, I think, needs no further explanation. With reference to Messrs. Robinson and Keller's letter (1685), their remarks *re* battleships are answered by Mr. Macdonald's letter (1680) in his final remarks *re* submarines, *i.e.*, the decks would be always awash.

Hoping to hear more correspondents' views on this matter.

Finchley. F. D. LEGG.

Stability.

[1739] It seems to be commonly assumed that "inherent stability" is an alternative to "automatic stability," but if stability is to be maintained either by manual or automatic adjustment of surfaces, it is of importance that no great angular velocity shall be acquired before the controls can be put in operation.

Any rigid design which keeps small the movement of the line of resultant pressure away from the centre of mass on any change of wind direction is therefore of the greatest value, whatever system of control be used, provided that the design is suitable for construction; and in this limited sense "inherent stability" is a necessary preliminary to the operation of any system of control, automatic or manual, without great force and great rapidity of action.

Bath. H. D. CAREY.

Aviation in Japan.

WITH a view to encouraging aviation, the Japanese Government has issued a decree granting pensions to amateur and professional aviators injured while flying, and grants will be made to the families of aviators killed while flying. Bonuses also will be given for each meritorious flight accomplished.

⊛ ⊛ ⊛ ⊛

IMPORTS AND EXPORTS, 1912-13.

AEROPLANES, airships, balloons, and parts thereof (not shown separately before 1910):—

	Imports.		Exports.		Re-Exportation.	
	1912.	1913.	1912.	1913.	1912.	1913.
	£	£	£	£	£	£
January ...	619	12,027	2,412	4,005	—	1,510
February	3,110	17,361	36	3,447	—	690
	3,729	29,458	2,448	7,452	—	2,200

⊛ ⊛ ⊛ ⊛

NEW COMPANIES REGISTERED.

British Wright Co., Ltd., 33, Chancery Lane, W.C.—Capital £6,000 in £1 shares. Constructors of aeroplanes and other aircraft, &c. Acquiring certain patents in the names of Orville and Wilbur Wright. First directors, O. Wright, G. Brewer, A. Ogilvie, G. N. Ogilvie, and T. P. Searight.

Dover Aviation Co., Ltd., Whitfield Aerodrome, Dover.—Capital £2,000 in £1 shares. Acquiring the business carried on at the Whitfield Aerodrome, Dover, as R. Chalmers. First directors, R. A. Chalmers and A. Bonsor.

Mann and Grimmer, Ltd.—Capital £5,000 in £1 shares (2,000 pref.). Aeronautical engineers and aeroplane manufacturers, &c. Acquiring the business carried on at 20, Arlington Road, Surbiton, as Mann and Grimmer. First directors, R. F. Mann, R. P. Grimmer, and D. S. Ball.

⊛ ⊛ ⊛ ⊛

PUBLICATIONS RECEIVED.

Les Aviettes. By G. Houard. Paris: Revue du Cerf-Volant, 1, Boulevard Henri IV. Price 1 fr.

The Bosch News. January, 1913. No. 1, Vol. 4. New York: The Bosch Magneto Co., 223–225, West 56th Street.

Catalogues.

Handley Page Aeroplanes. Handley Page, Ltd., 72, Victoria Street, S.W.

Astronomical, Scientific, and Mathematical Works. John Grant, 31, George IV Bridge, Edinburgh.

The London Aerodrome: Programmes Season, 1912. London: The Grahame-White Aviation, Co., Ltd., 166, Piccadilly, W.

The Automobile Engineer Year-Book for 1913. London: The Automobile Engineer Publishing Co., Ltd., 20, Tudor Street, E.C. Price 1*s.* net.

⊛ ⊛ ⊛ ⊛

Index and Title Page for Vol. IV.

THE index and title page for Vol. IV, January to December, 1912, has now been published and any reader can obtain a copy by sending 2*d.* to the publishers, 44, St. Martin's Lane, W.C. After March 22nd a charge of 6*d.*, post free, will be made.

⊛ ⊛ ⊛ ⊛

Aeronautical Patents Published.

Applied for in 1912.

Published March 13th, 1913.

4,378. G. B. H. AUSTIN. Aeroplanes.
18,219. L. P. MCKEONE. Aerocraft.

FLIGHT.

44, ST. MARTIN'S LANE, LONDON, W.C.

Telegraphic address: Truditur, London. Telephone: 1828 Gerrard.

SUBSCRIPTION RATES.

FLIGHT *will be forwarded, post free, at the following rates:—*

UNITED KINGDOM.	s.	d.	ABROAD.	s.	d.
3 Months, Post Free ...	3	9	3 Months, Post Free ...	5	0
6 ,, ,, ...	7	6	6 ,, ,, ...	10	0
12 ,, ,, ...	15	0	12 ,, ,, ...	20	0

Cheques and Post Office Orders should be made payable to the Proprietors of FLIGHT, 44, St. Martin's Lane, W.C., *and crossed London County and Westminster Bank, otherwise no responsibility will be accepted.*

Should any difficulty be experienced in procuring FLIGHT *from local newsvendors, intending readers can obtain each issue direct from the Publishing Office, by forwarding remittance as above.*